ANNALS

OF THE

CARNEGIE MUSEUM

VOLUME I.

1901–1902

W. J. HOLLAND, PH.D., SC.D., LL.D., *Editor*

J. B. HATCHER, PH.B., *Associate Editor*

PUBLISHED BY THE AUTHORITY OF THE
BOARD OF TRUSTEES OF THE CARNEGIE INSTITUTE

PRESS OF
THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

TABLE OF CONTENTS

LIST OF PLATES.

LIST OF FIGURES IN TEXT.

CORRIGENDA.

P. 150, 17th line from top, read *ovoviviparous* for oviparous.
P. 269, read *Faronus* for Rafonus.
P. 280, read *Faronus* for Rhaphanus.
P. 280, read *Rhexius* for Rexius.

ANNALS

OF THE

CARNEGIE MUSEUM

VOLUME I.

EDITORIAL.

THE publication of the observations and discoveries of those, who form the staff of a well-organized museum, has always been recognized as a proper function of such an institution. The body of scientific literature, which has emanated from the larger museums of Europe and America, is very considerable, and comprises some of the most important and valuable contributions, which have been made to science. Though the Carnegie Museum is the youngest of the great museums of America, and may be said only quite recently to have embarked upon its career of usefulness, the labors of those connected with it have already resulted in the accumulation of a large amount of material, possessing great scientific interest and value. The study of these collections is certain to throw much light upon many questions of profound interest. For the purpose of facilitating the diffusion of knowledge gained, often laboriously and at great expense, by those who are directly connected with the museum, as well as to form a medium for the publication of the results of the labors of others, who are associated with them, or are pursuing inquiries along the same, or kindred lines, the Trustees of the Institute have authorized the publication of two series of papers, which will be designated respectively as ANNALS and *Memoirs*. The ANNALS will appear in octavo form, the *Memoirs* in quarto. They will be published from time to time as material is provided, and when pages enough to form a volume have

been printed, a title-page, table of contents, and index will be supplied, and a new volume of each series will then be begun. Under the regulations, which have been adopted, twenty-five separata of articles prepared by authors will be furnished them at the expense of the institution. Should more be desired by an author, he may obtain them by giving notice, upon the acceptance of his article, of the number which he desires. The cost of printing separata over and above the number of twenty-five will be borne by the author.

The present issue of the ANNALS is the first which comes from the press. It appears with the dawn of a new century. It is the earnest hope of all concerned in this undertaking that the birth of this journal at this auspicious time may mark the beginning of a long and successful career, and that the dawn of the next century may find in the libraries of the world a long array of volumes, which, in the wealth of information which they contain, may justify the action of those who have sanctioned the beginning of this enterprise, and may prove to be a monument to the broad philanthropy and sagacity of the noble founder of the institution—ANDREW CARNEGIE.

MUSEUM NOTES.

(When not signed the Editor is responsible for these notes.)

IN the Accession List published in the Annual Report of the Museum for 1900, Mr. Thomas H. Hollis is credited with the gift to the Museum of a "hellbender," taken in the Monongahela River. The list is in error, in that the word "alligator" should have been used, instead of the name employed. The fact is that Mr. Hollis captured a small specimen of *Alligator mississippiensis* in the Monongahela river at the foot of Twenty-first Street, South Side. How the animal came to be there is a mystery. It has been suggested that it was brought up from Louisiana in the bilge-water of a coal-barge, and was pumped out into the river. How it could have found its way into a coal-barge is a problem. Another explanation, which seems more plausible is, that the specimen had escaped from captivity, or had been thrown into the river by some one, who had grown tired of keeping it as an aquarium pet.

WHILE speaking of the singular capture above mentioned, the Editor is reminded that at very nearly the same spot in the river, a few years

ago, a couple of men, while fishing, found what they supposed to be a piece of fossil wood. This they took to a beer saloon not far distant, and it was broken into pieces and distributed to different persons. One of the fragments found its way into the possession of the late Prof. B. C. Jillson, who at once recognized it as fossil ivory. He instituted an investigation and found out that the supposed piece of fossil wood was a portion of the tusk of a mastodon. Before it was broken up it measured about three feet in length. This is the only record, it is believed, of the finding of the remains of this beast within the limits of the city of Pittsburgh.

THE shooting by Dr. J. A. Doyle of an Otter (*Lutra hudsonica* Lacépède) in the Monongahela River, at Homestead, in March, 1899, was a rather remarkable occurrence. The animal has not been seen so near the city limits for many years. The specimen was secured for the Museum and has been finely prepared and mounted by Mr. F. S. Webster. (Acc. No. 895.)

THE Prairie Horned Lark (*Otocoris alpestris praticola* Henshaw) has been found nesting in Schenley Park for two summers past. This bird, with the opening of the country and the removal of the forests, has been gradually making its way eastward from the prairies of the Mississippi Valley.

THE White Pelican (*Pelecanus erythrorhynchos* Gmelin) is a rare bird in Pennsylvania. The late Mr. George B. Sennett is quoted in Warren's Birds of Pennsylvania as having seen a few of these birds near Erie about thirty years ago (1869). In 1874 one of a group of three or four of these birds was shot at Keating, Pa., on the Susquehanna, and, at the time when the Birds of Pennsylvania was written, the specimen was in the possession of a gentleman residing at Renovo. On October 13, 1898, three of these birds appeared on Conneaut Lake. One was shot on the morning of that day by Mr. William Foust; later in the day another was secured by Messrs. Douglas Stewart and Arthur W. Bell. Mr. Stewart secured the specimen shot by Mr. Foust, and had both specimens mounted by Ward's Natural Science Establishment, and presented them to the Carnegie Museum, where they now are.

THE OLIVE-SIDED FLYCATCHER (*Nuttallornis borealis* (Swainson)) IN WARREN COUNTY, PENNSYLVANIA.—Definite records, supported by specimens, of this species in western Pennsylvania have hitherto been lacking, so that the present instance becomes of interest. Having learned from Mr. R. B. Simpson of Warren, that a bird, believed to be the Olive-sided Flycatcher, had been seen near that place, I made a special visit to the locality late in June, (1900), in search of it. The exact spot, where the birds were found, was a small grove of hemlock and other trees along the Warren and Tidioute road, near the head of the west branch of Hickory Creek, and about four miles east of Cobham. Here a pair of the birds were discovered, their clear whistling note betraying their presence. They perched moderately high, but were not shy. Both birds were brought down, but unfortunately were not found. Another pair were met with in a similar situation about one and one-half miles southeast of Thompson Station, and this time both were secured. From this evidence it would seem that the species is a summer visitant, not rare in this general region.

W. E. CLYDE TODD.

ANOTHER LOCALITY FOR *Pipistrellus subflavus obscurus Miller.*—This bat, heretofore known only by specimens from the type locality, Lake George, New York, proves to be the common form at Beaver, Pennsylvania, several examples having been secured by the writer during the summers of 1899 and 1900, and having been compared with the type in the Biological Survey collection. In this connection it is interesting to note that a number of specimens procured from a cave at Hillside, Westmoreland County, Pa., in February, 1900, are true *P. subflavus.*

W. E. CLYDE TODD.

THROUGH the great kindness of Mr. Andrew Carnegie the Museum has received a series of replicas of some of the ancient carvings in stone, which are preserved in the Mexican National Museum in the city of Mexico. The reproductions were made by Señor Velasco, and are like those which are found in the American Museum of Natural History in Central Park, New York, which were made by Señor Velasco for that institution at the command of the Duc de Loubat. Unfortunately, the present limited space available for purposes of exhibition will prevent the setting up in its entirety of this notable addition to

the archæological collection. Many of the objects will have to remain encased in the boxes, in which they came, until the additions to the building, which are contemplated, are completed.

THE acquisition by the Museum of the collection of Coleoptera belonging to Mr. Henry Ulke, of Washington, D. C., is noticed by Mr. L. O. Howard, the Entomologist of the United States Department of Agriculture, in an article which appeared in the columns of *Science* for December the 14th, in which the learned writer pays a just and kind tribute to the distinguished gentleman whose industry brought together the collection. It is very gratifying to the authorities of the Museum to find Dr. Howard, at the conclusion of his article, making the statement that the entomological collections in the Carnegie Museum, enriched by this recent addition, form now one of the four greatest collections in the United States. "The other three great collections," we quote Dr. Howard, "are to be found at the Museum of Comparative Zoölogy, at Cambridge, Mass.; the Academy of Natural Sciences, at Philadelphia, Pa.; and the U. S. National Museum, Washington, D. C."

It is always pleasant to be recognized as keeping good company.

THE Pittsburgh Branch of the Egypt Exploration Fund, which has been in existence for only two years, has not labored in vain. In the year 1899 and in the year 1900 the Carnegie Museum has received important contributions of excellent material, unearthed by the antiquarians employed by the trustees of the fund. The collection, which has just come to hand, is from Abydos, where the tombs of the kings of the First Dynasty have been discovered and opened up. This collection will shortly be placed upon exhibition, and the kind friends who have contributed generously to the support of the fund will be pleased to know that what their generosity has secured for the local collection is available for examination and study.

THE palæontological expedition to the fossil-fields of Wyoming and Nebraska, which went out from the Museum in the early spring of the year 1900, has been eminently successful. An account of the work of the expedition was published by Professor Hatcher, the palæontolo-

gist in charge, in the columns of *Science*, New Series, Vol. XII, page 719. The work of excavation, begun at Camp Carnegie on Sheep creek, Albany county, Wyoming, by Dr. J. L. Wortman in the summer of 1899, was continued under the efficient direction of Mr. O. A. Peterson. The work yielded most satisfactory results. Additional portions of the skeleton of the great Diplodocus found in 1899 were recovered. A second specimen, apparently belonging to the same genus and species, was found in close proximity to the specimen discovered by Dr. Wortman and his party. The greater portion of this skeleton was recovered. Specimens representing six different individuals of Brontosaurus were unearthed not far away, and other important remains of Jurassic dinosaurs were recovered. The bones when packed made a carload, and were brought to the Museum in November, and have been deposited in the palæontological laboratory. Professor Hatcher, assisted by Mr. W. H. Utterback, devoted some time to a re-exploration of the Laramie beds in Converse County, Wyoming. It was here, a number of years ago, that Professor Hatcher discovered much of the most important material acquired by the late Professor Marsh, and belonging either to his collection, now at Yale University, or preserved in the U. S. National Museum at Washington, as part of the collections turned over to that institution by the U. S. Geological Survey. Professor Hatcher was not successful in recovering a complete skeleton of Triceratops, as he had hoped to be able to do, but nevertheless gathered together a great deal of important material representing the mammalian and ichthyic fauna of the Laramie deposits. One of the most interesting discoveries was that of a specimen showing the nature of the dermal covering of *Claosaurus* Marsh, an account and figure of which appear in this number of the ANNALS. Professor Hatcher subsequently removed from the location which he had chosen in Converse County to Sioux County, Nebraska, where in the White River beds he made fine collections, in reference to some portions of which the present number of the ANNALS contains an account from his pen. The expedition, viewing the results in their entirety, appears to have been very important, and has added a great deal of material to the collections of the Museum, which, when it shall have been mounted and prepared for exhibition, will not only serve to interest and attract the general public, but will materially add to our knowledge of the life of the past. Mr. W. H. Utterback, one of Professor Hatcher's assistants, remained in the West, and

is now engaged near Cañon City, Colorado, in re-opening the famous quarry on the property of Mr. M. P. Felch, which yielded to Professor Marsh in former years most of the skulls of dinosaurs which he obtained. At the time when Professor Marsh abandoned this quarry, because the work of stripping had become heavy, and his funds available for this use had run low, the stratum in which the bones occurred appeared to be as rich in fossils as when first opened. It is believed that by uncovering this vein of ossiferous rock, the Carnegie Museum will be able for a comparatively small sum to get a considerable amount of important material, which is needed for the reconstruction of the skeletons of these extinct monsters of the past. Mr. Utterback has been at work for about two months, and reports that he is making rapid progress. In a short time the fossil-bearing vein will be uncovered again.

I. THE CRAYFISH OF ALLEGHENY COUNTY, PA.

By E. B. Williamson.

With teachers and instructors the crayfish is a favorite type, both for dissection and for illustration, and yet but little attention is given to these interesting crustaceans from a systematic standpoint. Even among those who should be better informed the impression prevails that there is but one species in this country, or at least in the eastern United States, and that this single species belongs to the genus *Astacus*. As a matter of fact all the crayfishes in North America east of the Rocky Mountains, in the area drained by rivers flowing into the Atlantic Ocean, Hudson's Bay, and the Gulf of Mexico, and in the Island of Cuba, belong to the genus *Cambarus*.[1] One species of this genus is found in the Yellowstone River. Otherwise all the species west of the Rockies to the Pacific coast belong to the genus *Astacus*. Huxley, in his paper "On the Classification and the Distribution of the Crayfishes," Proceedings of the Zoological Society of London, 1878, pp. 752–788, has divided crayfishes into two groups, to which Faxon has given the rank of subfamilies. These subfamilies are the *Potamobiinæ*, the crayfishes of the northern hemisphere, and the *Parastacinæ*, the crayfishes of the southern hemisphere. The crayfishes of the northern hemisphere are naturally divided into two genera, *Astacus* and *Cambarus*. The distribution of these genera is very interesting. As stated above, in North America *Cambarus* occurs east of the Rocky Mountains and *Astacus* west. In Eastern Asia and Japan the crayfishes belong to the genus *Cambarus*, while in Europe and Western Asia they belong to the genus *Astacus*. That is, if one should move round the world on parallel 50 degrees north, for example, and should start in Eastern N. A. and then travel westward, he would successively encounter *Cambarus*, *Astacus*, *Cambarus*, and *Astacus*. This curious distribution has been explained by supposing that in the ocean, which lay to the north of both continents in past geological ages, both forms had appeared, though not as well separated as at present. When the

[1] Faxon, A Revision of the Astacidæ. See also Hagen, Monograph of the North American Astacidæ.

great changes took place that drove the life from these seas southward, both forms were widely distributed over the two continents. Then those climatic or other conditions, which have made possible the preservation of so many allied faunal and floral forms in Eastern North America and Eastern Asia, operated for the development of those characters which are found in the genus *Cambarus*, and the suppression of the characters of the genus *Astacus* in these widely separated regions.

At the present time Dr. Faxon recognizes about 68 species of *Cambarus* in North America, besides a large number of named subspecies and varieties. The number of species of the genus *Astacus* in Western North America is very much smaller. Up to the present time five species of *Cambarus* have been recorded from Pennsylvania. They are as follows: I. *C. bartonii* (Fabricius). II. *C. diogenes* Girard. III. *C. affinis* (Say). IV. *C. obscurus* Hagen. V. *C. rusticus* Girard. The following species are represented in the Carnegie Museum by specimens collected in Allegheny County during the past several years: *C. bartonii* (Fabricius); *C. bartonii*, var. *robustus* Hagen; *C. diogenes* Girard; *C. dubius* Faxon; *C. propinquus* Girard and *C. rusticus* Girard. *C. bartonii*, var. *robustus*, *C. propinquus*, and *C. dubius* have not hitherto been recorded from the State. In addition to the above 5 species and one variety, another species, *C. virilis* Hagen, is represented in the collection of the Museum. These specimens were collected from a lake in Ontario, Canada, by Mr. Geo. H. Clapp.

In descriptions of crayfish little attention has ever been given to their colors. In the first place there is generally little difference between species in this respect, and in the second place all specimens sooner or later fade, assuming a uniform yellowish or reddish tint.[1]

[1] The student will find the following works most valuable in his studies of American crayfishes. They contain descriptions of all recognized species:

I. Monograph of the North American Astacidæ, by Dr. H. A. Hagen, Museum of Comparative Zoology, Harvard College, 1870. II. A Revision of the Astacidæ, Walter Faxon, Part I. The Genera Cambarus and Astacus, Museum of Comparative Zoology, Harvard College, 1885. III. Notes on North American Crayfishes, Family Astacidæ, by the same author. U. S. National Museum, Vol. XII, pp. 619–634, 1890. IV. Observations on the Astacidæ in the U. S. National Museum, and in the Museum of Comparative Zoology, with descriptions of New Species, by the same author. U. S. National Museum, Vol. XX, pp. 643–694, 1898. V. The Crawfishes of the State of Indiana, by W. P. Hay. Indiana Department of Geology and Natural Resources, Twentieth Annual Report, W. S. Blatchley, 1895.

The following key, taken, with a few changes, from works by Hagen, Faxon, and Hay, will aid in identifying Allegheny county specimens.

I. Third segment of only the third pair of legs of the male hooked.

1. First pair of abdominal appendages of male ending in two thick recurved teeth; rostrum in both sexes without lateral teeth.

a. Areola wide, form depressed; brook species.

(1) Rostrum wide, sides subparallel. *C. bartonii.*

(2) Rostrum narrower, sides tapering to the apex. *C. bartonii, var. robustus.*

b. Areola narrow or obliterated; form compressed; burrowing species.

(1) Areola obliterated, color in life olive, greenish, or yellowish. *C. diogenes.*

(2) Areola narrow, color in life blue, or showing traces of blue. *C. dubius.*

II. First pair of abdominal appendages of male ending in two elongated, nearly straight, acute tips; rostrum in both sexes with lateral teeth.

a. Sides of rostrum straight; abdominal appendages shorter. *C. propinquus.*

b. Sides of rostrum concave, abdominal appendages longer, more tapering. *C. rusticus.*

The technical terms employed in this key may be briefly defined. For further details the student should consult any of the larger works on invertebrate anatomy. Crayfish are decapod (ten-footed) crustaceans. The first three pairs of legs are armed with pincers, which are most strongly developed on the first pair of legs, where they are known as *chelæ.* In all species the males may have the third segments of one or two pairs of legs *hooked,* that is armed with a prominent tubercle. The *abdominal appendages* correspond in position to the legs, and are attached, one pair to each segment, to the abdomen. In the males the first two pairs of these are modified, and the *first pair* are turned forward and pressed closely between the bases of the legs. Their various modifications offer the most valuable of all specific characters. The head and thorax are united to form the cephalothorax. This is covered by a firm chitinous shield, the carapace. The carapace is prolonged in front between the eyes to form the *rostrum.* The apex of the rostrum is more or less triangular in form, one angle of which forms the extreme apex of the rostrum. The other two angles may be rounded into the sides of the rostrum or they may be armed with spines, the *lateral teeth.* Near the middle of the carapace is a transverse groove, the cervical groove. Back of the cervical groove are two transverse grooves, and the space between them is the *areola.* When

the two transverse grooves meet along the middle line the areola is *obliterated* or *linear*.

1. *Cambarus bartonii* (Fabricius). This species is found in springs and smaller brooks, and rarely in larger streams. It has been taken in every ravine in Schenley Park and in a number of creeks throughout the county. It is the most common species. Adult specimens are uniform olive-brown in color, varying considerably as to shade. Younger individuals are paler and have the abdomen regularly mottled with brown.

2. *Cambarus bartonii*, var. *robustus* Hagen. A few specimens of this variety have been taken from Squaw Run, which empties into the Allegheny River about a mile and a half above Aspinwall. Observations indicate that this variety occurs in streams in which both *bartonii* and *propinquus* occur, the variety living in that part of the stream where the two species are found. A collector starting at the headwaters of Squaw Run would find *bartonii;* following the stream he would soon notice *robustus* among his captures; then an occasional *propinquus*, till finally *bartonii* would become rare and disappear, then *robustus* would disappear, and near the mouth of the creek he would find only the species *propinquus*. If the collector chose to follow on down the Allegheny River he would still notice only *propinquus*. After reaching the Ohio, a few specimens from the ripples about Neville Island would show him that he had found another species, *rusticus*.

3. *Cambarus diogenes* Girard. This species has been positively recorded from only one locality in the county, Fern Hollow, Pittsburgh. Two small specimens, probably this species, were taken from burrows near Silver Lake, Pittsburgh. This is the commonest and best known of the burrowing crayfishes. In life its color is olive, yellowish, or greenish, and occasionally with the sides of the carapace reddish.

4. *Cambarus dubius* Faxon. Specimens of this species collected in Allegheny County have been sent to Dr. Walter Faxon for identification. He considers them a local variety of this species, the Allegheny County specimens having the rostrum much narrower than the types. It has been taken in Schenley Park, in Fern Hollow, and from a spring in Moon Township. Like *diogenes* this is a burrowing species. In Fern Hollow during the autumn of 1898 the burrows were very numerous. The chimneys about the opening of the burrows are on an aver-

age constructed much more neatly by *diogenes* than by *dubius*. The habits of the former species have been carefully described by a number of observers. The burrows of *dubius* are generally more intricate than those of *diogenes*. In both species the burrows occupied by smaller individuals are usually a simple tunnel ending in a small pocket which is placed at such a depth that it is filled with water. On September 24, 1898, one burrow at Fern Hollow, typical of those inhabited by large individuals of *dubius*, contained an adult female and 47 young. The chimney was about three inches high, broad and flattened and not composed of compact pellets as is usually the case with *diogenes*, and was closed at the top. The burrow was circular and about one and one-half inches in diameter with the sides smooth. It ran, in a slightly oblique direction, with two or three turns, to a depth of about fourteen inches where it ended in a pocket, half filled with water which contained the mother and young. The capacity of this pocket exceeded a pint. A number of passages led off from the main tunnel. One of these branched, one part going to the surface and ending in a low, closed chimney, the other running to within an inch of the surface, where it ended. The remaining side tunnels, one of which branched, ended in pockets. The capacity of one of these was not less than a quart. The entrance and exit to the pockets were by the same tunnel. These pockets are certainly, in the case of this species, not formed accidentally as a result of deepening the tunnels from time to time, when this becomes necessary in order to reach the water, but are built for some purpose, as is shown by their size and form and by the fact that in many cases the entrance to the pocket is from below and not from above, as would be the case had the pocket or chamber originally been the bottom of a tunnel. At some places in Fern Hollow the ground was fairly honey-combed with burrows. Starting from one chimney it was sometimes possible, by tracing the many branches, to prove that several chimneys had tunnels which were connected with each other. Like *diogenes* this species is nocturnal. Mr. S. N. Rhoads had traps set for small mammals in Fern Hollow, and on several occasions, when visiting these traps in the morning, he found specimens of this crayfish in them. The bait used in these traps was a raisin, with a pinch of oatmeal scattered about. In this locality the color of the specimens of this species during life is usually a clear bright blue below, with the articulations pale. A few individuals had the blue on the carapace largely replaced by dull brown.

The chelæ are blue, becoming yellowish near the extreme tip, which is red. The tubercles of the chelæ are yellow. The antennæ are dark blue, with the alternating rings paler. The young mentioned above as having been taken from their tunnel, varied in total length from three-fourths to one and one-eighth inches. In color they were bluish green, rarely pale and flesh colored. Faxon has recorded that in the Indian Territory the Indians call this species "red crayfish." For this locality "blue crayfish" will be an appropriate name.

5. *Cambarus propinquus* Girard. This common species has been taken in the Allegheny and Monongahela Rivers and in many of the small streams throughout the county. In color it is variable, being usually a clear brownish green, tinged with red and with a large red blotch on the side of the carapace near the posterior edge.

6. *Cambarus rusticus* Girard. Ohio River, Neville Island. This species is similar in color to *propinquus*, which species it very much resembles.

II. A PRELIMINARY LIST OF THE VASCULAR FLORA OF ALLEGHENY COUNTY, PENNSYLVANIA.

By John A. Shafer, Ph.G.

After waiting a number of years for the appearance of a Flora of Allegheny County, Pennsylvania, from another source, I have concluded to supply the deficiency in a manner as comprehensive as is possible with the material at present available.

At best the present list must be regarded as wholly preliminary. Nevertheless it is published in the hope that it may serve as a guide to students in their systematic work, as well as an invitation to others to participate in the preparation of a fuller and more perfect catalogue in the near future. Collectors are accordingly urged to make full records of each species wherever found. It is further hoped, and confidently expected, that all who use this list will submit to the writer the lists which they make, so as to render possible the compilation of a final catalogue. Those who submit such lists are also requested to kindly accompany them with herbarium specimens, in order to insure a correct identification. These specimens should, if possible, be submitted in duplicate ; one set to be incorporated with the herbarium of the Carnegie Museum, in order to preserve a comprehensive representation of the species and its stations, the other set to be returned to the contributor after examination, determination, and study. Due credit will be given in the Museum catalogues, or future publications, for the specimens donated, or submitted. Explicit data as to the time of flower and fruit, (both of which should be collected), as well as the location, should be made and recorded on the labels. In noting location great exactness should be observed, and the collector should enter upon his labels the township, and even the farm and field, and in towns the name of the street and the number of the lot. Collectors in neighboring counties are invited to use this list for their respective districts, and likewise to submit their lists and specimens, with a view to the future preparation of a complete catalogue of the flora of western Pennsylvania.

No attempt has been made to utilize some of the quite recently

published revisions of a few of the more difficult groups. The order of arrangement is as nearly as possible that of Gray's Manual, sixth edition, selected only as a matter of convenience to those for whom this list is principally intended. The writer, being in the fullest accord with the nomenclature of the most recent authors, all are urged to acquire the "new names" at the earliest moment. To aid in this, the names used in Britton & Brown's Illustrated Flora of the Northern States and Canada are employed, those of Gray's Manual, where synonyms, being in italics. The numbers succeeding the natural order are those employed by Britton & Brown, and may serve as a guide to the arrangement of an herbarium in accordance with the accepted classification, the greater divisions being indicated by the Roman numerals, as follows:

I. Pteridophyta.
II. Gymnospermæ.
III. Monocotyledones.
IV. Chloripetalæ.
V. Gamopetalæ.

The arrangement will at once be understood. No attempt at localizing the species is made except where it is considered rare and has been found but once or twice.

JOHN A. SHAFER.

Explanation of the signs used in this list:
* The specimen is in the herbarium of the Carnegie Museum.
|| The species has been seen by the writer, but is not in the herbarium.
† Reported, but is not in the herbarium.
§ The species may occur here, having been reported from a neighboring county.
? Reported, but of doubtful occurrence.
The blank space under each species is intended for the use of students of botany and collectors, who may desire to insert notes, or the names of additional species.

RANUNCULACEÆ Jussieu.

CROWFOOT FAMILY. IV–26.

CLEMATIS Linnæus.

* **C. Virginiana** Linnæus. Virgin's bower.

* **C. Viorna** Linnæus. Leather-flower.
Near Oakdale Station, June, 1873, Professor B. H. Patterson.

ATRAGENE Linnæus.

§ **A. Americana** Sims. Purple virgin's bower.
Clematis verticillaris De Candolle.

ANEMONE Linnæus.

* **A. Virginiana** Linnæus. Tall anemone.

* **A. Canadensis** Linnæus. Canada anemone.
A. Pennsylvanica Linnæus.
Hampton Township, Herron Station, July 2, 1891, Dr. A. Koenig.

* **A. quinquefolia** Linnæus. Wind-flower.
Shaler Township, branch of Pine Creek, near Glenshaw, April 22, 1886.

§ **A. trifolia** Linnæus. Mountain anemone.

HEPATICA Scopoli.

* **H. Hepatica** (Linnæus). Round liver-leaf.

* **H. acuta** (Pursh). Pointed liver-leaf.

SYNDESMON Hoffmansegg.

ANEMONELLA Spach.

* **S. thalictroides** (Linnæus). Rue-anemone.

THALICTRUM Linnæus.

* **T. dioicum** Linnæus. Early meadow-rue.

* **T. polygamum** Muhlenberg. Tall meadow-rue.

* **T. purpurascens** Linnæus. Purplish meadow-rue.

TRAUTVETTERIA Fischer & Meyer.

* **T. Carolinensis** (Walter). False bugbane.
T. palmata Fischer & Meyer.
Banks of Ohio River, near Pittsburgh, July 4, 1888, C. D. Beadle.

RANUNCULUS Linnæus.

* **R. abortivus** Linnæus. Small-flowered crowfoot.

§ **R. micranthus** Nuttall. Rock-crowfoot.
R. abortivus var. *micranthus* A. Gray.

† **R. sceleratus** Linnæus. Cursed crowfoot.

* **R. recurvatus** Poiret. Hooked crowfoot.

* **R. fascicularis** Muhlenberg. Tufted buttercup.

* **R. septentrionalis** Poiret. Marsh buttercup.

† **R. Pennsylvanicus** Linnæus. Bristly buttercup.

† **R. bulbosus** Linnæus. Bulbous buttercup.

* **R. acris** Linnæus. Meadow buttercup.

BATRACHIUM S. F. Gray.

† **B. trichophyllum** (Chaix). Water-crowfoot.
Ranunculus aquatilis var. *trichophyllus* De Candolle.

CALTHA Linnæus.

* **C. palustris** Linnæus. Marsh-marigold.

AQUILEGIA Linnæus.

* **A. Canadensis** Linnæus. Wild columbine.

|| **A. vulgaris** Linnæus. European columbine.
Moon Township, roadside west of Carnot, June, 1888.

DELPHINIUM Linnæus.

* **D. urceolatum** Jacquin. Tall larkspur.
D. exaltatum Aiton.
Patton Township, east of Wall's Station, Aug. 24, 1869, Rev. S. W. Knipe.

* **D. tricorne** Michaux. Dwarf larkspur.
A white form is occasionally found.

* **D. Consolida** Linnæus. Field larkspur.
Escaped to roadsides, Harrison and Moon Townships.

CIMICIFUGA Linnæus.

? **C. Americana** Michaux. American bugbane.

* **C. racemosa** (Linnæus). Black cohosh.

ACTÆA Linnæus.

† **A. rubra** (Aiton). Red baneberry.

* **A. alba** (Linnæus). White baneberry.

HYDRASTIS Ellis.

* **H. Canadensis** Linnæus. Golden seal.

MAGNOLIACEÆ J. St. Hilaire.

MAGNOLIA FAMILY. IV–24.

MAGNOLIA Linnæus.

* **M. acuminata** Linnæus. Cucumber-tree.

LIRIODENDRON Linnæus.

* **L. Tulipifera** Linnæus. Tulip-tree.

ANONACEÆ De Candolle.

CUSTARD APPLE FAMILY. IV–25.

ASIMINA Adanson.

* **A. triloba** (Linnæus). North American papaw.

MENISPERMACEÆ De Candolle.

MOONSEED FAMILY. IV–28.

CEBATHA Forskal.

COCCULUS De Candolle.

? **C. Carolina** (Linnæus). Carolina moonseed.

MENISPERMUM Linnæus.

* **M. Canadense** Linnæus. Moonseed.

BERBERIDACEÆ Torrey & Gray.

BARBERRY FAMILY. IV–27.

BERBERIS Linnæus.

§ **B. vulgaris** Linnæus. European barberry.

CAULOPHYLLUM Michaux.

* **C. thalictroides** Michaux. Blue cohosh.

JEFFERSONIA Barton.

* **J. diphylla** (Linnæus). Twin-leaf.

PODOPHYLLUM Linnæus.

* **P. peltatum** Linnæus. May-apple.

NYMPHÆACEÆ De Candolle.

WATER-LILY FAMILY. IV–22.

CASTALIA Salisbury.

NYMPHÆA Tournefort.

§ **C. odorata** (Dryander). White water-lily.
N. odorata Aiton.

§ **C. tuberosa** (Paine). Tuberous water-lily.
N. tuberosa Paine.

NYMPHÆA Linnæus.

NUPHAR Smith.

§ **N. advena** Solander. Yellow pond-lily.
Nuphar advena Aiton.

Note.—None of the water-lilies have been reported from Allegheny County.

SARRACENIACEÆ La Pylaie.

PITCHER-PLANT FAMILY. IV–35.

SARRACENIA Linnæus.

§ **S. purpurea** Linnæus. Pitcher-plant.

In the absence of bogs, we can scarcely hope to find it in Allegheny County.

PAPAVERACEÆ B. Jussieu.

POPPY FAMILY. IV–31.

SANGUINARIA Linnæus.

* **S. Canadensis** Linnæus. Bloodroot.

STYLOPHORUM Nuttall.

† **S. diphyllum** (Michaux). Yellow poppy.

CHELIDONIUM Linnæus.

* **C. majus** Linnæus. Celandine.

PAPAVER Linnæus.

* **P. somniferum** Linnæus. Common poppy.

|| **P. dubium** Linnæus. Long smooth-fruited poppy.
Pittsburgh, Bailey Ave., July, 1888.

ARGEMONE Linnæus.

† **A. Mexicana** Linnæus. Prickly poppy.

ADLUMIA Rafinesque.

* **A. fungosa** (Aiton). Alleghany vine.
A. cirrhosa Rafinesque.
Shaler Township, P. & W. R. R. tunnel, Sept., 1886, Hon. J. D. Shafer.

BICUCULLA Adanson.

DICENTRA Bernhardi.

* **B. Cucullaria** (Linnæus). Dutchman's breeches.
Dicentra Cucullaria Gray.

* **B. Canadensis** (Goldie). Squirrel-corn.
Dicentra Canadensis Gray.

CAPNOIDES Adanson.

CORYDALIS Ventenat.

* **C. sempervirens** (Linnæus). Pale corydalis.
Corydalis glauca Pursh.
Harrison Township, rocks, on roadside near John Parke's, July 8, 1900.

† **C. flavulum** (Rafinesque). Yellow corydalis.
Corydalis flavula De Candolle.

* **C. aureum** (Willdenow). Golden corydalis.
Corydalis aurea Willdenow.

FUMARIA Linnæus.

† **F. officinalis** Linnæus. Fumitory.

CRUCIFERÆ B. Jussieu.

MUSTARD FAMILY. IV–32.

DENTARIA Linnæus.

* **D. diphylla** Michaux. Pepper-root.

* **D. laciniata** Muhlenberg. Cut-leaved toothwort.

|| **D. heterophylla** Nuttall. Slender toothwort.
Pittsburgh, 23d Ward, near Salt-works Station, 1888, Prof. W. S. Jackman.

CARDAMINE Linnæus.

† **C. hirsuta** Linnæus. Hairy bitter-cress.

* **C. Pennsylvanica** Muhlenberg. Pennsylvania bitter-cress.

* **C. purpurea** (Torrey). Purple cress.
South Fayette Township, near Marshalsea, May 11, 1900.

* **C. bulbosa** (Schreber). Bulbous cress.
C. rhomboidea De Candolle.

* **C. rotundifolia** Michaux. American water-cress.

ARABIS Linnæus.

* **A. lyrata** Linnæus. Rock-cress.

* **A. dentata** (Torrey). Toothed rock-cress.
Neville Township, south shore of island, May 3, 1890; O'Hara Township, river bank near Ross Station, May 9, 1900.

* **A. lævigata** (Muhlenberg). Smooth rock-cress.

* **A. lævigata Burkii** Porter. Burk's rock-cress.

* **A. Canadensis** Linnæus. Sickle-pod.

† **A. glabra** (Linnæus). Tower mustard.
A. perfoliata Lamarck.

DRABA Linnæus.

* **D. verna** Linnæus. Whitlow-grass.

KONIGA Adanson.

ALYSSUM Tournefort.

* **K. maritima** (Linnæus). Sweet alyssum.
Sewickley, "ashery," foot of Walnut street, August, 1892. Spreading! August 10, 1897.

RORIPA Scopoli.

NASTURTIUM R. Brown.

† **R. Nasturtium** (Linnæus). Water-cress.
N. officinale R. Brown.

* **R. palustris** (Linnæus). Marsh-cress.
N. palustre De Candolle.

* **R. Armoracia** (Linnæus). Horseradish.

BARBAREA R. Brown.

* **B. Barbarea** (Linnæus). Common winter-cress.
B. vulgaris R. Brown.

† **B. præcox** (J. E. Smith). Scurvy-grass.

HESPERIS Linnæus.

* **H. matronalis** Linnæus. Dame's rocket.

ERYSIMUM Linnæus.

* **E. cheiranthoides** Linnæus. Worm-seed mustard.

SISYMBRIUM Linnæus.

* **C. officinale** (Linnæus). Hedge-mustard.

† **S. altissimum** Linnæus. Tall hedge-mustard.

STENOPHRAGMA Celakowsky.

* **S. Thaliana** (Linnæus). Mouse-ear cress.
Sisymbrium Thalianum Gay.
South Fayette Township, dry, stony point, R.R., west of Bridgeville, June 11, 1900.

IODANTHUS Torrey and Gray.

THELYPODIUM Endlicher.

* **I. pinnatifidus** (Michaux). False rocket.
Patton Township, Wall's Station, Aug. 24, 1869, Rev. S. W. Knipe; June 10, 1891, Thomas Seal.

BRASSICA Linnæus.

* **B. nigra** (Linnæus). Black mustard.

† **B. arvensis** (Linnæus). Wild mustard.

* **B. campestris** Linnæus. Turnip.
Frequently persists for several years.

BURSA Weber.

CAPSELLA Medicus.

* **B. Bursa-pastoris** (Linnæus). Shepherd's purse.

LEPIDIUM Linnæus.

* **L. Virginicum** Linnæus. Wild pepper-grass.

* **L. campestre** (Linnæus). Field-cress.
Moon Township, Shafer farm, May 22, 1895.
Harrison Township, John Potts', near Natrona road, June, 1895.

RAPHANUS Linnæus.

† **R. Raphanistrum** Linnæus. Wild radish.

* **R. sativus** Linnæus. Garden radish.
Frequently persists for several years.

CAPPARIDACEÆ Lindley.

CAPER FAMILY. IV–33.

CLEOME Linnæus.

* **C. spinosa** Linnæus. Spider-flower.
C. pungens Willdenow.
Esplin, bank of Ohio River, near P. & L. E. R. R. station, September, 1898.

CISTACEÆ Lindley.

ROCKROSE FAMILY. IV–78.

HELIANTHEMUM Persoon.

† **H. Canadense** (Linnæus). Rock-rose.

LECHEA Linnæus.

† **L. minor** Linnæus. Thyme-leaved pin-weed.

* **L. racemulosa** Michaux. Oblong-fruited pin-weed.

VIOLACEÆ De Candolle.

VIOLET FAMILY. IV–79.

VIOLA Linnæus.

† **V. pedata** Linnæus. Bird's-foot violet.

* **V. palmata** Linnæus. Hand-leaved violet.

* **V. obliqua** Hill. Meadow violet.
A white flowering form, near Perrysville, March 30, 1889, Dr. A. Ziegler.

† **V. villosa** Walter. Southern wood violet.

* **V. domestica** Bicknell. Yard violet.

† **V. cucullata** Aiton. Marsh blue violet.

* **V. communis** Pollard. Common blue violet.

* **V. sagittata** Aiton. Arrow-leaved violet.

* **V. ovata** Nuttall. Ovate-leaved violet.

* **V. blanda** Willdenow. Sweet white violet.

§ **V. blanda amœna** (Le Conte). Swamp sweet violet.
V. blanda var. *palustriformis* Gray.

* **V. primulæfolia** Linnæus. Primrose-leaved violet.
Neville Township, head of island, July, 1898.

* **V. lanceolata** Linnæus. Lance-leaved violet.

† **V. rotundifolia** Michaux. Round-leaved violet.

* **V. pubescens** Aiton. Hairy yellow violet.

* **V. scabriuscula** (Torrey and Gray). Smoothish yellow violet.

§ **V. hastata** Michaux. Halberd-leaved violet.

* **V. Canadensis** Linnæus. Canada violet.

* **V. striata** Aiton. Striped violet.

† **V. Labradorica** Schrank. American dog violet.
V. canina L. var. *Muhlenbergii* Trautvetter.

* **V. rostrata** Pursh. Long-spurred violet.

CUBELIUM Rafinesque.

SOLEA Sprengel.

* **C. concolor** (Forster). Green violet.
S. concolor Gingins de Lassaraz.

CARYOPHYLLACEÆ Reichenbach.

PINK FAMILY. IV–21.

DIANTHUS Linnæus.

* **D. Armeria** Linnæus. Deptford pink.
Allegheny City, Riverview Park, July 14, 1894, Dr. W. R. Hamilton.

* **D. barbatus** Linnæus. Sweet-william.
Moon Township, Shrode's Hollow, near Carnot, June, 1897.

SAPONARIA Linnæus.

* **S. officinalis** Linnæus. Soapwort.

SILENE Linnæus.

* **S. stellata** (Linnæus). Starry campion.

* **S. alba** Muhlenberg. White campion.
S. nivea Otth.

* **S. vulgaris** (Mœnch.). Bladder-campion.
S. Cucubalus Wibel.
Penn Township, Doak farm, Sept. 21, 1899.

* **S. Caroliniana** Walter. Wild pink.
S. Pennsylvanica Michaux.

* **S. Virginica** Linnæus. Fire-pink.

* **S. antirrhina** Linnæus. Sleepy catchfly.
"Pittsburgh, May, 1886"; Prof. B. H. Patterson, A. V. R. R. track, June, 1900.

* **S. noctiflora** Linnæus. Night-flowering catchfly.
Moon Township, Miller's lane, west of Carnot, June 10, 1899.

* **S. Armeria** Linnæus. Sweet-william catchfly.

LYCHNIS Linnæus.

* **L. coronaria** (Linnæus). Mullein-pink.
Moon Township: escaped from old gardens; 1898.

AGROSTEMMA Linnæus.

* **A. Githago** Linnæus. Corn cockle.
Lychnis Githago Scopoli.

ARENARIA Linnæus.

* **A. serpyllifolia** Linnæus. Thyme-leaved sandwort.
Moon Township, Narrows Run, May, 1899.

MŒHRINGIA Linnæus.

* **M. lateriflora** (Linnæus). Blunt-leaved sandwort.
Arenaria lateriflora Linnæus.

ALSINE Linnæus.

STELLARIA Linnæus.

* **A. media** Linnæus. Common chickweed.

* **A. pubera** (Michaux). Great chickweed.

* **A. longifolia** (Muhlenberg). Long-leaved chickweed.

* **A. longipes** (Goldie). Long-stalked chickweed.

? **A. uliginosa** (Murray). Marsh chickweed.

CERASTIUM Linnæus.

* **C. viscosum** Linnæus. Mouse-ear chickweed.

* **C. vulgatum** Linnæus. Larger mouse-ear chickweed.

* **C. longipedunculatum** Muhlenberg. Nodding chickweed.

* **C. arvense** Linnæus. Field chickweed.
Pittsburgh, "in a lawn, Oakland, June 4, 1888"; Prof. B. H. Patterson.

SPERGULA Linnæus.

† **S. arvensis** Linnæus. Cornspurry.
Allegheny, Highwood Cemetery, 1893; John Ferguson.

ANYCHIA Michaux.

* **A. dichotoma** Michaux. Forked chickweed.

* **A. Canadensis** (Linnæus). Slender forked chickweed.
A. capillacea De Candolle.

PORTULACACEÆ Reichenbach.

PURSLANE FAMILY. IV–20.

PORTULACA Linnæus.

* **P. oleracea** Linnæus. Common purslane.

* **P. grandiflora** Hooker. Portulaca.
Occasionally spontaneous.

CLAYTONIA Linnæus.

* **C. Virginica** Linnæus. Narrow springbeauty.

* **C. Caroliniana** Michaux. Broad springbeauty.

ELATINACEÆ Lindley.

WATERWORT FAMILY. IV–77.

ELATINE Linnæus.

E. Americana (Pursh). Mud-purslane.
Probably overlooked on account of its minuteness.

HYPERICACEÆ Lindley.

ST. JOHN'S-WORT FAMILY. IV–76.

HYPERICUM Linnæus.

§ **H. Ascyron** Linnæus. Great St. John's-wort.

* **H. prolificum** Linnæus. Shrubby St. John's-wort.

* **H. ellipticum** Hooker. Pale St. John's-wort.

* **H. perforatum** Linnæus. Common St. John's-wort.

* **H. maculatum** Walter. Spotted St. John's-wort.

* **H. mutilum** Linnæus. Dwarf St. John's-wort.

† **H. Canadense** Linnæus. Canadian St. John's-wort.

SAROTHRA Linnæus.

* **S. gentianoides** Linnæus. Orange-grass.
Hypericum nudicaule Walter.

TRIADENUM Rafinesque.

ELODEA Pursh.

* **T. Virginicum** (Linnæus). Marsh St. John's-wort.
E. campanulata Pursh.
Harrison Township, Joseph Johnston's, June, 1900.

MALVACEÆ Necker.

MALLOW FAMILY. IV–74.

ALTHÆA Linnæus.

* **A. rosea** Cavanilles. Hollyhock.
Sewickly, "ashery," foot of Walnut St., 1893.
Harrison Township, field of Joseph Johnston, July, 1896.

MALVA Linnæus.

* **M. rotundifolia** Linnæus. Common mallow.

* **M. sylvestris** Linnæus. High mallow.
Pittsburgh, old gardens, 31st Ward, 1886.

|| **M. Moschata** Linnæus. Musk mallow.
Harrison Township, Freeport road, near Wormley's barn, July, 1895.

SIDA Linnæus.

* **S. spinosa** Linnæus. Prickly sida.

ABUTILON Gaertner.

* **A. Abutilon** (Linnæus). Velvet-leaf.
A. Avicennæ Gærtner.

HIBISCUS Linnæus.

* **H. Trionum** Linnæus. Venice mallow.
Harrison Township, Breckenridge's hillside, Natrona, July 25, 1895.
Swissvale, August 19, 1900, John M. Milligan.

TILIACEÆ Jussieu.

LINDEN FAMILY. IV–73.

TILIA Linnæus.

* **T. Americana** Linnæus. Bass-wood.

† **T. heterophylla** Ventenat. White bass-wood.

LINACEÆ Dumortier.

FLAX FAMILY. IV–52.

LINUM Linnæus.

* **L. Virginianum** Linnæus. Wild yellow flax.

§ **L. striatum** Walter. Ridged yellow flax.

* **L. usitatissimum** Linnæus. Common flax.
Spontaneous, especially along railroad tracks.

GERANIACEÆ J. St. Hilaire.

GERANIUM FAMILY. IV–50.

GERANIUM Linnæus.

* **G. maculatum** Linnæus. Crane's-bill.

* **G. Carolinianum** Linnæus. Carolina crane's-bill.
Pittsburgh, Stanton Ave., June 14, 1884.

* **G. pusillum** Linnæus. Small flowered crane's-bill.

LIMNANTHACEÆ Lindley.

FALSE MERMAID FAMILY. IV–61.

FLŒRKEA Willdenow.

* **F. proserpinacoides** Willdenow. False mermaid.

OXALIDACEÆ Lindley.

WOOD-SORREL FAMILY. 10–51.

OXALIS Linnæus.

§ **O. Acetosella** Linnæus. True wood-sorrel.

* **O. violacea** Linnæus. Violet wood-sorrel.

* **O. corniculata** Linnæus. Yellow procumbent wood-sorrel.
A weed about greenhouses.

* **O. stricta** Linnæus. Upright yellow wood-sorrel.

† **O. cymosa** Small. Tall yellow sorrel.

* **O. grandis** Small. Great yellow wood-sorrel.
O. recurva Trelease, not Elliott.

BALSAMINACEÆ Lindley.

JEWEL-WEED FAMILY.

IMPATIENS Linnæus.

* **I. aurea** Muhlenberg. Pale touch-me-not.
I. pallida Nuttall.

* **I. biflora** Walt. Spotted touch-me-not.
I. fulva Nuttall.

RUTACEÆ Jussieu.

RUE FAMILY. IV–54.

XANTHOXYLUM Linnæus.

* **X. Americanum** Miller. Prickly ash.
Moon Township, roadside, Mrs. Eliot's, on Flaugherty Run.
Findlay Township, Chas. Hood's, May, 1897.

SIMARUBACEÆ De Candolle.

AILANTHUS FAMILY. IV–53.

AILANTHUS Desfontaine.

* **A. glandulosa** Desfontaine. Ailanthus.
Spontaneous in and about most towns.

ILICACEÆ Lowe.

HOLLY FAMILY. IV–64.

ILEX Linnæus.

§ **I. monticola mollis** (A. Gray). Broad-leaved holly.

† **I. verticillata** (Linnæus). Black alder.

* **I. lævigata** (Pursh). Smooth winter-berry.
Robinson Township, swamp near Groveton Station, October, 1888.

CELASTRACEÆ Lindley.

STAFF-TREE FAMILY. IV–65.

CELASTRUS Linnæus.

* **C. scandens** Linnæus. False bittersweet.

EUONYMUS Linnæus.

* **E. atropurpureus** Jacquin. Wahoo.

RHAMNACEÆ Dumortier.

BUCKTHORN FAMILY. IV–71.

CEANOTHUS Linnæus.

* **C. Americanus** Linnæus. New Jersey tea.

VITACEÆ Lindley.

GRAPE FAMILY. IV–72.

VITIS Linnæus.

§ **V. Labrusca** Linnæus. Fox-grape.

* **V. æstivalis** Michaux. Summer grape.

* **V. cordifolia** Michaux. Frost grape.

* **V. vulpina** Linnæus. Riverside grape.
V. riparia Michaux.

† **V. rupestris** Scheele. Sand grape.

PARTHENOCISSUS Planchon.

AMPELOPSIS Michaux.

* **P. quinquefolia** (Linnæus). Virginia creeper.

HIPPOCASTANACEÆ Torrey and Gray.

BUCKEYE FAMILY. IV–68.

ÆSCULUS Linnæus.

* **Æ. glabra** Willdenow. Ohio buckeye.

Forward Township, in a clearing near Gamble's P. O., June 1886.

* **Æ. octandra** Marshall. Sweet buckeye.
Æ. flava Aiton.

ACERACEÆ St. Hilaire.

MAPLE FAMILY. IV–67.

ACER Linnæus.

§ **A. Pennsylvanicum** Linnæus. Striped maple.

* **A. spicatum** Lambert. Mountain-maple.

* **A. Saccharum** Marshall. Rock- or sugar-maple.

* **A. nigrum** Michaux. Black sugar-maple.

* **A. saccharinum** Linnæus. Silver maple.
A. dasycarpum Ehrhart.

* **A. rubrum** Linnæus. Red, or swamp maple.

With us this tree grows on rocky hillsides, seldom in lowlands.

* **A. Negundo** Linnæus. Ash-leaved maple.

STAPHYLEACEÆ De Candolle.

BLADDER-NUT FAMILY. IV–66.

STAPHYLEA Linnæus.

* **S. trifolia** Linnæus. American bladder-nut.

ANACARDIACEÆ Lindley.

SUMAC FAMILY. IV–62.

RHUS Linnæus.

* **R. hirta** (Linnæus). Staghorn sumac.
R. typhina Linnæus.

* **R. glabra** Linnæus. Smooth sumac.

* **R. copallina** Linnæus. Dwarf sumac.

* **R. Vernix** Linnæus. Poison sumac.
R. venenata De Candolle.
O'Hara Township, Swamp by W. P. R. R., near Allegheny City Poor Farm, Nov., 1899.

* **R. radicans** Linnæus. Poison ivy.

† **R. aromatica** Aiton. Fragrant sumac.

POLYGALACEÆ Reichenbach.

MILKWORT FAMILY. IV–56.

POLYGALA Linnæus.

† **P. paucifolia** Willdenow. Fringed milkwort.

† **P. polygama** Walter. Racemed milkwort.

† **P. Senega** Linnæus. Seneca snakeroot.

* **P. viridescens** Linnæus. Purple milkwort.
P. sanguinea Linnæus.

* **P. verticillata** Linnæus. Whorled milkwort.

* **P. ambigua** Nuttall. Loose-spiked milkwort.

PAPILIONACEÆ Linnæus.

PEA FAMILY. IV–49.

BAPTISIA Ventenat.

§ **B. tinctoria** Ventenat. Yellow wild indigo.

* **B. australis** (Linnæus). Blue wild indigo.

CYTISUS Linnæus.

* **C. scoparius** (Linnæus). Scotch broom.
Sterrett Township, P. R. R. embankment west of Swissvale, June 19, 1889; C. C. Mellor.

LUPINUS Linnæus.

† **L. perennis** Linnæus. Wild lupine.

TRIFOLIUM Linnæus.

* **T. incarnatum** Linnæus. Crimson clover.

* **T. arvense** Linnæus. Rabbit-foot clover.
Moon Township, dry woods near Sharon church, Sept., 1888–89.
Allegheny, Highwood Cemetery, July, 1896; John Ferguson.

* **T. pratense** Linnæus. Red clover.

* **T. reflexum** Linnæus. Buffalo clover.
Bellevue, "hillside, Ohio River, near Jack's Run, July, 1869"; Rev. S. W. Knipe.
Sewickley Township, branch of Turkey Foot Run, July, 1886.

† **T. stoloniferum** Muhlenberg. Running buffalo clover.

* **T. repens** Linnæus. White clover.

* **T. hybridum** Linnæus. Alsike clover.

* **T. agrarium** Linnæus. Hop-clover.
Chartiers Township, near Ingram Station, July, 1886; Alfred Stengle.
Patton Township, high dry hill, east of Pitcairn Station, August 15, 1900.

§ **T. procumbens** Linnæus. Low hop-clover.

MELILOTUS Jussieu.

* **M. officinalis** (Linnæus). Yellow sweet-clover.

* **M. alba** Desvaux. White sweet-clover.

MEDICAGO Linnæus.

* **M. sativa** Linnæus. Alfalfa.

* **M. lupulina** Linnæus. Hop medic.

CRACCA Linnæus.

TEPHROSIA Persoon.

* **C. Virginiana** Linnæus. Goat's-rue.

ROBINIA Linnæus.

* **R. Pseudacacia** Linnæus. Locust-tree.

* **R. hispida** Linnæus. Rose acacia.
Tarentum, roadside, escaped from garden, August, 1900.

ASTRAGALUS Linnæus.

* **A. Carolinianus** Linnæus. Milk vetch.
A. Canadensis Linnæus.
Moon Township, Thorn Run road, near A. Brown's, July, 1895.

MEIBOMIA Adanson.

DESMODIUM Desvaux.

* **M. nudiflora** Linnæus. Naked-flowered tick-trefoil.

† **M. grandiflora** Walter. Pointed-leaved tick-trefoil.
D. acuminatum De Candolle.

† **M. pauciflora** (Nuttall). Few-flowered tick-trefoil.

* **M. Michauxii** Vail. Prostrate tick-trefoil.
D. rotundifolium De Candolle.

* **M. canescens** (Linnæus). Hoary tick-trefoil.

† **M. bracteosa** (Michaux). Large-leaved tick-trefoil.
D. cuspidatum Hooker.

† **M. viridiflora** (Linnæus). Velvet-leaved tick-trefoil.

† **M. Dillenii** (Darlington). Dillen's tick-trefoil.

* **M. paniculata** (Linnæus). Panicled tick-trefoil.

† **M. Canadensis** (Linnæus). Showy tick-trefoil.

† **M. rigida** (Elliott). Rigid tick-trefoil.

LESPEDEZA Michaux.

* **L. repens** (Linnæus). Creeping bush-clover.

† **L. procumbens** Michaux. Trailing bush-clover.

* **L. violacea** (Linnæus). Bush-clover.

* **L. Virginica** (Linnæus). Slender bush-clover.
L. reticulata Persoon.

* **L. hirta** (Linnæus). Hairy bush-clover.
L. polystachya Michaux.

* **L. capitata** Michaux. Round-headed bush-clover.
Robinson Township, near Groveton Station, Oct. 10, 1899.

STYLOSANTHES Swartz.

§ **S. biflora** (Linnæus). Pencil-flower.
S. elatior Swartz.

VICIA Linnæus.

* **V. sativa** Linnæus. Common vetch.

† **V. Cracca** Linnæus. Tufted vetch.

* **V. Caroliniana** Walter. Carolina vetch.

† **V. Americana** Muhlenberg. American vetch.

LATHYRUS Linnæus.

† **L. palustris** Linnæus. Marsh vetchling.

APIOS Mœnch.

* **A. Apios** (Linnæus). Ground-nut.
A. tuberosa Mœnch.

FALCATA Gmelin.

AMPHICARPA Elliott.

* **F. comosa** (Linnæus). Wild pea-nut.
A. monoica Nuttall.

* **F. Pitcheri** (Torrey & Gray). Pitcher's hog-nut.

CÆSALPINACEÆ Klotsch & Garcke.

SENNA FAMILY. IV–47.

CERCIS Linnæus.

* **C. Canadensis** Linnæus. Red-bud.

CASSIA Linnæus.

* **C. Marylandica** Linnæus. Wild senna.

* **C. Chamæcrista** Linnæus. Partridge pea.

* **C. nictitans** Linnæus. Wild sensitive-plant.

GYMNOCLADUS Lamarck.

† **G. dioica** (Linnæus). Kentucky coffee-tree.
G. Canadensis Lamarck.

GLEDITSIA Linnæus.

* **G. triacanthos** Linnæus. Honey-locust.

DRUPACEAÆ De Candolle.

PLUM FAMILY. IV–45.

PRUNUS Linnæus.

* **P. Americana** Marshall. Wild plum.

* **P. domestica** Linnæus. Garden plum.

* **P. pumila** Linnæus. Sand cherry.

† **P. Pennsylvanica** (Linné). Wild red cherry.

* **P. Virginiana** Linnæus. Choke cherry.

† **P. demissa** (Nuttall). Western wild cherry.

* **P. serotina** Ehrhart. Wild black cherry.

* **P. Cerasus** Linnæus. Sour cherry.

* **P. Avium** Linnæus. Sweet cherry.

* **P. Padus** Linnæus. European bird cherry.
Pittsburgh, spontaneous on the Southside hills, 32d Ward.

AMYGDALUS Linnæus.

* **A. Persica** Linnæus. Peach.
Spontaneous throughout the county.

ROSACEÆ B. Jussieu.

ROSE FAMILY. IV–43.

SPIRÆA Linnæus.

* **S. salicifolia** Linnæus. Willow-leaved meadow-sweet.

* **S. tomentosa** Linnæus. Hardhack.
Harrison Township, wet roadside, John Potts', June, 1895.

* **S. sorbifolia** Linnæus. Ash-leaved spiræa.
Moon Township, escaped to roadsides, Narrows Run, June, 1897.

* **S. Virginiana** Britton. Virginia spiræa.
O'Hara Township, head of Darlington's Hollow, July 7, 1900; W. N. Miller.

ARUNCUS Adanson.

* **A. Aruncus** (Linnæus). Goat's-beard.
Spiræa Aruncus Linnæus.

ULMARIA Hill.

† **U. rubra** Hill. Queen of the prairie.
Spiræa lobata Gronovius.

OPULASTER Medicus.

PHYSOCARPUS Maximowicz.

* **O. opulifolius** (Linnæus). Ninebark.
P. opulifolius Maximowicz.

PORTERANTHUS Britton.

GILLENIA Mœnch.

* **P. trifoliatus** (Linnæus). Indian physic.
G. trifoliata Mœnch.

* **P. stipulatus** (Muhlenberg). American ipecac.
G. stipulacea Mœnch.
Moon Township, woods, McKee property, June, 1898.

RUBUS Linnæus.

* **R. odoratus** Linnæus. Thimble-berry.

* **R. strigosus** Michaux. Wild red raspberry.
Tarentum, foot of island, July, 1900.

* **R. occidentalis** Linnæus. Black raspberry.
A yellow-fruited variety occurs in Moon Township, near Carnot.

* **R. Americanus** (Persoon). Dwarf raspberry.
R. triflorus Richards.

* **R. villosus** Aiton. High bush blackberry.

§ **R. Alleghaniensis** Porter. Mountain blackberry.

* **R. hispidus** Linnæus. Running swamp blackberry.
Harrison Township, swamp below Joseph Johnston's house, July, 1897.

* **R. Canadensis** Linnæus. Dewberry.

DALIBARDA Linnæus.

† **D. repens** Linnæus. Dalibarda.

GEUM Linnæus.

* **G. Canadense** Jacquin. White avens.
G. album Gmelin.

† **G. Virginianum** Linnæus. Rough avens.

* **G. strictum** Aiton. Yellow avens.
Hampton Township, ditches, P. & W. R. R., north of Semple Station, Aug. 10th, 1900.

* **G. vernum** (Rafinesque). Spring avens.

WALDSTEINIA Willdenow.

* **W. fragarioides** (Michaux). Barren strawberry.

FRAGARIA Linnæus.

† **F. Virginiana** Duchesne. Scarlet strawberry.

† **F. vesca** Linnæus. European wood strawberry.

* **F. Americana** (Porter). American wood strawberry.
A form with "white" fruit from Moon Township seems to belong here.

POTENTILLA Linnæus.

* **P. arguta** Pursh. Tall cinquefoil.
Robison Township, near Groveton, July 20, 1898.
Moon Township, Barns' Farm, near Stoop's Ferry, August, 1899.

* **P. Monspeliensis** Linnæus. Rough cinquefoil.
P. Norvegica Linnæus.

† **P. intermedia** Linnæus. Downy cinquefoil.

* **P. recta** Linnæus. Rough fruited cinquefoil.
Allegheny, Campus Western University of Pennsylvania, August, 1900.

* **P. Canadensis** Linnæus. Five-finger.

* **P. pumila** Poiret. Dwarf five-finger.

AGRIMONIA Linnæus.

* **A. hirsuta** Muhlenberg. Common agrimony.
A. Eupatoria Linnæus.

* **A. parviflora** Solander. Small-flowered agrimony.

SANGUISORBA Linnæus.

POTERIUM Linnæus.

* **S. Canadensis** Linnæus. Canadian burnet.
Harrison Township, Little Bull Creek, near Tarentum "Waterworks," August 30, 1892, Dr. A. Koenig. August, 1896, J. A. Shafer.

ROSA Linnæus.

* **R. setigera** Michaux. Climbing rose.
Harrison Township, McWilliams' Hollow, July, 1895.
O'Hara Township, roadside east of Aspinwall, June, 1900.

? **R. blanda** Aiton. Smooth rose.

* **R. Carolina** Linnæus. Swamp rose.

* **R. humilis** Marshall. Low pasture rose.

* **R. humilis lucida** (Ehrhart). Pasture rose.
R. lucida Ehrhart.

† **R. canina** Linnæus. Dog rose.

* **R. rubiginosa** Linnæus. Sweetbrier.

POMACEÆ Linnæus.

APPLE FAMILY. IV–44.

PYRUS Linnæus.

* **P. communis** Linnæus. Choke-pear.
Occasionally in margin of woods, Moon Township, etc.

MALUS Jussieu.

PYRUS Linnæus.

* **M. coronaria** (Linnæus). American crab-apple.

* **M. angustifolia** (Aiton). Narrow leaved crab-apple.
South Fayette, near Herriottsville, May, 1871, May 15, 1900, Rev. S. W. Knipe.

* **M. Malus** (Linnæus). Apple.
Frequently escaped to woods and thickets.

SORBUS Linnæus.

PYRUS Linnæus.

* **S. sambucifolia** Chamisso & Schlechtendahl. Western mountain-ash.
Pittsburgh, 18th Ward, rear of cemetery, June, 1885.
" Haight's Run, July, 1899.

ARONIA Linnæus.

PYRUS Linnæus.

* **A. nigra** (Willdenow). Black choke-berry.
Harrison Township, "Bird's Hollow," near Natrona, June, 1895.

CRATÆGUS Linnæus.

* **C. Oxyacantha** Linnæus. English hawthorn.

† **C. coccinea** Linnæus. Scarlet haw.

† **C. macrantha** Loddiges. Long-spined thorn.

* **C. mollis** (Torrey & Gray). Red-fruited haw.

* **C. tomentosa** Linnæus. Pear haw.

* **C. punctata** Jacquin. Large-fruited haw.

* **C. Crus-Galli** Linnæus. Cockspur thorn.

AMELANCHIER Medicus.

* **A. Canadensis** (Linnæus). Service-berry.

* **A. Botryapium** (Linné). Shad-bush.

* **A. spicata** (Lamarck). Low June-berry.
Allegheny, Highwood Cemetery, on rocky hill, May, 1898, John Ferguson.

SAXIFRAGACEÆ Dumortier.

SAXIFRAGE FAMILY. IV–39.

SAXIFRAGA Linnæus.

* **S. Virginiensis** Michaux. Early saxifrage.

* **S. Pennsylvanica** Linnæus. Swamp saxifrage.
Pine Township, swamp west of Wexford. June, 1896.

TIARELLA Linnæus.

* **T. cordifolia** Linnæus. Coolwort.
Pittsburgh, "Homewood Hollow," May, 1896.

HEUCHERA Linnæus.

* **H. Americana** Linnæus. Alum-root.

MITELLA Tournefort.

* **M. diphylla** Linnæus. Mitrewort.

CHRYSOSPLENIUM Linnæus.

* **C. Americanum** Schweinitz. Water carpet.
Harrison Township, borders of Little Bull Creek, May 3, 1893, Dr. Adolph Koenig; May, 1900, J. A. Shafer.

HYDRANGEA Linnæus.

* **H. arborescens** Linnæus. Wild hydrangea.

PHILADELPHUS Linnæus.

* **P. coronarius** Linnæus. Mock orange.
Occasionally escaped from gardens.

GROSSULARIACEÆ Dumortier.

GOOSEBERRY FAMILY. IV–40.

RIBES Linnæus.

* **R. Cynosbati** Linnæus. Wild gooseberry.

† **R. oxyacanthoides** Linnæus. Northern gooseberry.

* **R. Uva-crispa** Linnæus. Garden gooseberry.
R. Grossularia Linnæus.
Occasionally escaped.

* **R. floridum** L'Heritier. Wild black currant.

* **R. rubrum** Linnæus. Red currant.
Occasionally escaped.

CRASSULACEÆ De Candolle.

ORPINE FAMILY. IV–38.

SEDUM Linnæus.

‖ **S. Telephium** Linnæus. Live-forever.
Moon Township, roadside west of Carnot.

† **S. acre** Linnæus. Yellow stonecrop.

* **S. ternatum** Michaux. Wild stonecrop.

PENTHORUM Linnæus.

* **P. sedoides** Linnæus. Ditch stonecrop.

DROSERACEÆ S. F. Gray.

SUNDEW FAMILY. IV–36.

DROSERA Linnæus.

§ **D. rotundifolia** Linnæus. Round-leaved sundew.

HAMAMELIDACEÆ Lindley.

WITCH-HAZEL FAMILY. IV-41.

HAMAMELIS Linnæus.

* **H. Virginiana** Linnæus. Witch-hazel.

HALORAGIDACEÆ Klotsch & Garcke.

WATER-MILFOIL FAMILY. IV-89.

MYRIOPHYLLUM Linnæus.

† **M. verticillatum** Michaux. Water-milfoil.

LYTHRACEÆ Lindley.

LOOSESTRIFE FAMILY. IV-85.

LYTHRUM Linnæus.

* **L. alatum** Pursh. Winged loosestrife.

East Deer Township, Kennedy Station, July, 1890, Dr. Adolph Koenig.

Hampton Township, bottom of old milldam, Semple Station, August 10, 1900.

* **L. Salicaria** Linnæus. Purple loosestrife.

Allegheny, Highwood Cemetery, escaped; John Ferguson.

PARSONSIA Patrick Browne.

CUPHEA Patrick Browne.

* **P. petiolata** (Linnæus). Clammy cuphea.

C. viscosissima Jacquin.

ONAGRACEÆ Dumortier.

EVENING-PRIMROSE FAMILY. IV-87.

LUDWIGIA Linnæus.

* **L. alternifolia** Linnæus. Seed-box.

ISNARDIA Linnæus.

LUDWIGIA Linnæus.

* **I. palustris** Linnæus. Water-purslane.

EPILOBIUM Linnæus.

* **E. coloratum** Muhlenberg. Purple-leaved willow-herb.

CHAMÆNERION Adanson.

* **C. angustifolium** (Linnæus). Great willow-herb.

ONAGRA Adanson.

ŒNOTHERA Linnæus.

* **O. biennis** (Linnæus). Evening-primrose.

KNEIFFIA Spach.

ŒNOTHERA Linnæus.

* **K. pumila** (Linnæus). Small sun-drops.

* **K. fruticosa** (Linnæus). Sun-drops.

GAURA Linnæus.

* **G. biennis** Linnæus. Biennial gaura.
McKees Rocks, near the Indian Mound, August, 1896. C. C. Mellor.

CIRCÆA Linnæus.

* **C. Lutetiana** Linnæus. Enchanter's nightshade.

§ **C. alpina** Linnæus. Smaller enchanter's nightshade.

PASSIFLORACEÆ Dumortier.

PASSION-FLOWER FAMILY. IV-80.

PASSIFLORA Linnæus.

* **P. lutea** Linnæus. Yellow passion-flower.

UMBELLIFERÆ B. Jussieu.

CARROT FAMILY. IV–91.

DAUCUS Linnæus.

* **D. Carota** Linnæus. Wild carrot.

ANGELICA Linnæus.

* **A. villosa** (Walter). Pubescent angelica.
A. hirsuta Muhlenberg.

OXYPOLIS Rafinesque.

TIEDEMANNIA De Candolle.

§ **O. rigidus** (Linnæus). Cow-bane.

HERACLEUM Linnæus.

* **H. lanatum** Michaux. Cow-parsnip.

PASTINACA Linnæus.

* **P. sativa** Linnæus. Wild parsnip.

THASPIUM Nuttall.

* **T. barbinode** (Michaux). Hairy-jointed meadow-parsnip.
Pittsburgh, hillside above Salt-works Station, June 17, 1898.

FŒNICULUM Adanson.

* **F. Fœniculum** (Linnæus). Fennel.
F. officinale Allioni.
O'Hara Township, W. P. R. R. embankment near Squaw Run, July, 1900.

ANETHRUM Linnæus.

* **A. graveolens** Linnæus.
Moon Township, roadside, Narrows Run, July, 1889.

PIMPINELLA Linnæus.

* **P. integerrima** (Linnæus). Yellow pimpernel.

DERINGA Adanson.

CRYPTOTÆNIA De Candolle.

* **D. Canadensis** (Linnæus). Honewort.

SIUM Linnæus.

† **S. cicutæfolium** Gmelin. Water-parsnip.

ZIZIA Koch.

* **Z. aurea** (Linnæus). Golden meadow-parsnip.

* **Z. cordata** (Walter). Heart-leaved Alexanders.

CICUTA Linnæus.

* **C. maculata** Linnæus. Spotted water-hemlock.

CONIUM Linnæus.

* **C. maculatum** Linnæus. Poison hemlock.

CHÆROPHYLLUM Linnæus.

* **C. procumbens** (Linnæus). Spreading chervil.

O'Hara Township, woods below railroad, near Aspinwall, May, 1900.

WASHINGTONIA Rafinesque.

OSMORRHIZA Rafinesque.

* **W. Claytoni** (Michaux). Woolly sweet-cicely.

O. brevistylis De Candolle.

* **W. longistylis** (Torrey). Sweet-cicely.

ERIGENIA Nuttall.

§ **E. bulbosa** (Michaux). Harbinger of spring.

HYDROCOTYLE Linnæus.

* **H. Americana** Linnæus. Marsh-pennywort.
Sterrett Township, near Edgewood, May, 1886, C. C. Mellor.

SANICULA Linnæus.

* **S. Marylandica** Linnæus. Black sanicle.

* **S. Canadensis** Linnæus. Short-styled sanicle.

ARALIACEÆ Ventenat.

GINSENG FAMILY. IV–90.

ARALIA Linnæus.

* **A. spinosa** Linnæus. Angelica tree.

* **A. racemosa** Linnæus. Spikenard.

* **A. nudicaulis** Linnæus. Wild sarsaparilla.

PANAX Linnæus.

* **P. quinquefolium** Linnæus. Ginseng.

§ **P. trifolium** Linnæus. Dwarf ginseng.

CORNACEÆ Link.

DOG-WOOD FAMILY. IV–92.

CORNUS Linnæus.

* **C. florida** Linnæus. Flowering dog-wood.

† **C. circinata** L'Heritier. Round-leaved cornel.

* **C. Amonum** Miller. Silky cornel.
C. sericea Linnæus.

* **C. stolonifera** Michaux. Red-osier cornel.

* **C. candidissima** Marshall. Panicled cornel.
C. paniculata L'Heritier.

NYSSA Linnæus.

* **N. sylvatica** Marshall. Sour gum.

CAPRIFOLIACEÆ Ventenat.

HONEYSUCKLE FAMILY. V–35.

SAMBUCUS Linnæus.

* **S. Canadensis** Linnæus. American elder.

* **S. pubens** Michaux. Red-berried elder.

VIBURNUM Linnæus.

§ **V. alnifolium** Marshall. Hobble-bush.
V. lantanoides Michaux.

* **V. acerifolium** Linnæus. Maple-leaved arrow-wood.

* **V. pubescens** (Aiton). Downy arrow-wood.
Pittsburgh, Butler street, beyond Morningside Road, June, 1884.

§ **V. dentatum** Linnæus. Arrow-wood.

* **V. Lentago** Linnæus. Sweet viburnum.
Fawn Township, Little Bull Creek, at branch to Donaldville, June, 1896.

* **V. prunifolium** Linnæus. Black haw.

TRIOSTEUM Linnæus.

* **T. perfoliatum** Linnæus. Horse-gentian.

SYMPHORICARPOS Jussieu.

* **S. racemosus** Michaux. Snowberry.
Only as an escaped species with us.

* **S. Symphoricarpos** (Linnæus). Coral-berry.
S. vulgaris Michaux.
Escaped from old gardens.

LONICERA Linnæus.

* **L. glaucescens** Rydberg. Douglas' honeysuckle.
Moon Township, Wm. Tomlinson's woods, May, 1897.

* **L. sempervirens** Linnæus. Trumpet honeysuckle.
Harrison Township, McWilliams' Hollow, near Natrona, June, 1895.

* **L. Japonica** Thunberg. Japanese honeysuckle.
Occasionally escaped.

* **L. ciliata** Muhlenberg. American fly-honeysuckle.
Shaler Township, near P. and W. R. R. tunnel, May, 1886.

DIERVILLA Mœnch.

* **D. Diervilla** (Linnæus). Bush honeysuckle.
D. trifida Mœnch.
Hulton, "on river bank, 1888," Dr. Adolph Koenig.

RUBIACEÆ B. Jussieu.

MADDER FAMILY. V–34.

HOUSTONIA Linnæus.

* **H. cœrulea** Linnæus. Bluets.

* **H. ciliolata** Torrey. Fringed houstonia.

North Versailles Township, near Wall's Station, July, 1869; Rev. S. W. Knipe.

North Versailles Township, near Wall's Station, May 10, 1891; Thos. Seal.

* **H. longifolia** Gaertner. Long-leaved houstonia.

Sewickley Township, dry hills, Turkey-foot Run, June, 1885.

Moon Township, T. A. Shafer farm, June, 1886.

CEPHALANTHUS Linnæus.

* **C. occidentalis** Linnæus. Button-bush.

MITCHELLA Linnæus.

* **M. repens** Linnæus. Partridge-berry.

GALIUM Linnæus.

† **G. Aparine** Linnæus. Cleavers.

* **G. pilosum** Aiton. Hairy bedstraw.

* **G. lanceolatum** Torrey. Torrey's wild licorice.

* **G. circæzans** Michaux. Wild licorice.

* **G. boreale** Linnæus. Northern bedstraw.

† **G. trifidum** Linnæus. Small bedstraw.

† **G. concinnum** Torrey & Gray. Shining bedstraw.

† **G. triflorum** Michaux. Fragrant bedstraw.

VALERIANACEÆ Batsch.

VALERIAN FAMILY. V–37.

VALERIANA Linnæus.

* **V. pauciflora** Michaux. Large-flowered valerian.

* **V. officinalis** Linnæus. Garden valerian.
Sterrett Township, woods near Edgewood, July, 1897, C. C. Mellor.

VALERIANELLA Pollich.

* **V. Locusta** (Linnæus). European corn-salad.
V. olitoria Pollich.

* **V. chenopodifolia** (Pursh). Goose-foot corn-salad.
V. fagopyrum Torrey & Gray.
South Fayette Township, near Herriottsville, May, 1871, and May 15, 1900, Rev. S. W. Knipe.

* **V. radiata** (Linnæus). Beaked corn-salad.
O'Hara Township, Squaw Run, June, 1900.

DIPSACACEÆ Lindley.

TEASEL FAMILY. V–38.

DIPSACUS Linnæus.

* **D. sylvestris** Hudson. Wild teasel.

CUCURBITACEÆ B. Jussieu.

GOURD FAMILY. V–39.

SICYOS Linnæus.

* **S. angulatus** Linnæus. One-seeded bur-cucumber.

MICRAMPELIS Rafinesque.

ECHINOCYSTIS Torrey & Gray.

* **M. lobata** (Michaux). Wild balsam-apple.

COMPOSITÆ Adanson.

THISTLE FAMILY. V–43.

VERNONIA Schreber.

* **V. Noveboracensis** (Linnæus). New York iron-weed.

† **V. gigantea** (Walter). Tall iron-weed.

EUPATORIUM Linnæus.

* **E. maculatum** Linnæus. Spotted Joe-Pye weed.

† **E. purpureum** Linnæus. Purple boneset.

* **E. Torreyanum** Short. Torrey's boneset.
Fawn Township, Pine Hill, July, 1900.

* **E. sessilifolium** Linnæus. Upland boneset.

† **E. rotundifolium** Linnæus. Round-leaved thoroughwort.

* **E. perfoliatum** Linnæus. Boneset.

* **E. ageratoides** (Linné). White snake-root.

† **E. aromaticum** Linnæus. Smaller white snake-root.

* **E. cœlestinum** Linnæus. Mist-flower.

LACINARIA Hill.

LIATRIS Schreber.

† **L. squarrosa** (Linnæus). Colic-root.

SOLIDAGO Linnæus.

* **S. squarrosa** Muhlenberg. Stout ragged golden-rod.

* **S. cæsia** Linnæus. Woodland golden-rod.

* **S. flexicaulis** Linnæus. Zig-zag golden-rod.
S. latifolia Linnæus.

* **S. bicolor** Linnæus. Silver-rod.

* **S. rugosa** Miller. Wrinkled golden-rod.

* **S. patula** Muhlenberg. Spreading golden-rod.

Avalon, branch of Spruce Run, near stone bridge, September, 1896, James Semple.

O'Hara Township, swamp near Allegheny City Poor Farm, October, 1899.

* **S. ulmifolia** Muhlenberg. Elm-leaved golden-rod.

† **S. neglecta** Torrey & Gray. Swamp golden-rod.

* **S. juncea** Aiton. Early golden-rod.

† **S. arguta** Aiton. Cut-leaved golden-rod.

† **S. rupestris** Rafinesque. Rock golden-rod.

* **S. serotina** Aiton. Late golden-rod.

† **S. serotina gigantea** (Aiton). Tall late golden-rod.

* **S. Canadensis** Linnæus. Canada golden-rod.

* **S. nemoralis** Aiton. Field golden-rod.

EUTHAMIA Nuttall.

SOLIDAGO Linnæus.

* **E. graminifolia** (Linnæus). Bushy golden-rod.
S. lanceolata Linnæus.

SERIOCARPUS Nees.

* **S. asteroides** (Linnæus). White-topped aster.
S. conyzoides Nees.

ASTER Linnæus.

* **A. divaricatus** Linnæus. White wood aster.
A. corymbosus Aiton.

* **A. glomeratus** (Nees). Bernhardi's aster.

* **A. macrophyllus** Linnæus. Large- eaved aster.

* **A. Shorti**ooker. Short's aster.

* **A. azureus** Lindley. Sky-blue aster.

* **A. cordifolius** Linnæus. Common blue aster.

* **A. Lowrieanus** Porter. Lowrie's aster.

* **A. sagittifolius** Willdenow. Arrow-leaved aster.

* **A. undulatus** Linnæus. Wavy-leaved aster.

* **A. patens** Aiton. Late purple aster.

† **A. phlogifolius** Muhlenberg. Thin-leaved purple aster.

* **A. Novæ-Angliæ** Linnæus. New England aster.

* **A. oblongifolius** Nuttall. Aromatic aster.

† **A. amethystinus** Nuttall. Amethyst aster.

* **A. puniceus** Linnæus. Red-stalked aster.

* **A. prenanthoides** Muhlenberg. Crooked-stemmed aster.

* **A. lævis** Linnæus. Smooth aster.

* **A. dumosus** Linnæus. Bushy aster.

* **A. salicifolius** Aiton. Willow aster.

* **A. paniculatus** Lamarck. Tall white aster.

* **A. Tradescanti** Linnæus. Michaelmas daisy.

* **A. ericoides** Linnæus. White heath aster.

* **A. lateriflorus** (Linnæus). Starved aster.
A. diffusus Aiton.

* **A. hirsuticaulis** Lindley. Hairy-stemmed aster.
McCandless Township, Perrysville Road, October, 1896.

* **A. vimineus** Lamarck. Small white aster.

* **A. multiflorus** Aiton. White wreath aster.

DŒLLINGERIA Nees.

ASTER Linnæus.

* **D. umbellata** (Miller). Flat-top aster.
Springdale Township, near Robert Stewart's, September, 1896.

* **D. infirma** (Michaux). Cornel-leaved aster.

IONACTIS Greene.

ASTER Linnæus.

§ **I. linariifolius** (Linnæus). Stiff-leafed aster.

ERIGERON Linnæus.

* **E. annuus** Linnæus White-top.

* **E. ramosus** (Walter). Daisy fleabane.
E. strigosus Muhlenberg.

* **E. pulchellus** Michaux. Robin's plantain.
E. bellidifolius Muhlenberg.

* **E. Philadelphicus** Linnæus. Philadelphia fleabane.

LEPTILON Rafinesque.

ERIGERON Linnæus.

* **L. Canadense** (Linnæus). Canada fleabane.

GIFOLA Cassini.

FILAGO Linnæus.

* **G. Germanica** (Linnæus). Cottonrose.
Fawn Township, Bull Creek, on dry hill near Tarentum, July, 1886.

ANTENNARIA Gærtner.

* **A. neodioica** Greene. Small cat's-foot.
Sewickley Township, dry hill near Turkey-foot Run, July, 1886.
Moon Township, T. A. Shafer heirs' farm, June, 1887.

† **A. neglecta** Greene. Field cat's-foot.

* **A. plantaginifolia** (Linnæus). Plantain-leaf everlasting.

ANAPHALIS DeCandolle.

* **A. margaritacea** (Linnæus). Pearly everlasting.
Moon Township, Flaugherty Run, on Phillips' place, August, 1898, Hugo Roste.

GNAPHALIUM Linnæus.

* **G. obtusifolium** Linnæus. Life everlasting.
G. polycephalum Michaux.

* **G. decurrens** Ives. Winged cudweed.
Moon Township, old field in McKee tract, September 15, 1894.

* **G. uliginosum** Linnæus. Low cudweed.

* **G. purpureum** Linnæus. Purplish cudweed.

INULA Linnæus.

* **I. Helenium** Linnæus. Elecampane.

CALENDULA Linnæus.

* **C. officinalis** Linnæus. Garden marigold.
Sewickley Township, roadside, Turkey-foot Run Road, October 7, 1886.

POLYMNIA Linnæus.

* **P. Canadensis** Linnæus. Smaller leaf-cup.
Baldwin Township, hillside, east of Baldwin Station, August, 1886, Alfred Stengel.

* **P. Uvedalia** Linnæus. Larger leaf-cup.

SILPHIUM Linnæus.

* **S. laciniatum** Linnæus. Compass-plant.
Allegheny, spontaneous in Highwood Cemetery.

* **S. trifoliatum** Linnæus. Whorled rosin-weed.

ECLIPTA Linnæus.

* **E. alba** (Linnæus). Eclipta.
Pittsburgh, Allegheny wharf, near Third St., Aug. 15, 1884.

HELIOPSIS Persoon.

* **H. helianthoides** (Linnæus). Ox-eye.
H. lævis Persoon.

BRAUNERIA Necker.

ECHINACEA Mœnch.

* **B. pallida** Nuttall. Purple cone-flower.
E. angustifolia De Candolle.
Sterrett Township, near Brushton, June 20, 1887. C. C. Mellor.

RUDBECKIA Linnæus.

* **R. laciniata** Linnæus. Tall cone-flower.

* **R. hirta** Linnæus. Yellow cone-flower.

* **R. fulgida** Aiton. Orange cone-flower.
Fawn Township, branch of Bull Creek, near Thomas Dickson's. June, 1895.

RATIBIDA Rafinesque.

LEPACHYS Rafinesque.

* **R. pinnata** (Ventenat). Gray-headed cone-flower.
L. pinnata Torrey & Gray.
Moon Township, Flaugherty Run, on Phillips' place, August, 1898, Hugo Roste.

HELIANTHUS Linnæus.

* **H. annuus** Linnæus. Common sunflower.

* **H. mollis** Lamarck. Hairy sunflower.

* **H. giganteus** Linnæus. Tall sunflower.

* **H. Maximiliani** Schrader. Maximilian's sunflower

* **H. grosse-serratus** Martens. Saw-tooth sunflower.

* **H. microcephalus** Torrey & Gray. Small sunflower.
H. parviflorus Bernhardi.

† **H. doronicoides** Lamarck. Oblong-leaved sunflower.

* **H. divaricatus** Linnæus. Woodland sunflower.

* **H. hirsutus** Rafinesque. Stiff-haired sunflower.

* **H. strumosus** Linnæus. Pale-leaved sunflower.

* **H. tracheliifolius** Linnæus. Throatwort sunflower.

* **H. decapetalus** Linnæus. Thin-leaved sunflower.

* **H. tuberosus** Linnæus. Jerusalem artichoke.

VERBESINA Linnæus.

ACTINOMERIS Nuttall.

* **V. alternifolia** (Linnæus). Golden star.
A. squarrosa Nuttall.

COREOPSIS Linnæus.

* **C. tripteris** Linnæus. Tall tickseed.

BIDENS Linnæus.

* **B. frondosa** Linnæus. Beggar-ticks.

† **B. connata** Muhlenberg. Purple-stemmed beggar-ticks.

† **B. cernua** Linnæus. Small bur-marigold.

* **B. lævis** (Linnæus). Large bur-marigold.
B. chrysanthemoides Michaux.

* **B. bipinnata** Linnæus. Spanish needles.

GALINSOGA Ruiz & Pavon.

* **G. parviflora** Cavanilles. Galinsoga.

HELENIUM Linnæus.

* **H. autumnale** Linnæus. Sneezeweed.

ANTHEMIS Linnæus.

* **A. Cotula** Linnæus. Mayweed.

ACHILLEA Linnæus.

* **A. Millefolium** Linnæus. Yarrow.

CHRYSANTHEMUM Linnæus.

* **C. Leucanthemum** Linnæus. Ox-eye daisy.

* **C. Parthenium** Persoon. Feverfew.
Moon Township, roadside near Carnot, July, 1898.

TANACETUM Linnæus.

* **T. vulgare** Linnæus. Tansy.

ARTEMISIA Linnæus.

* **A. Absinthium** Linnæus. Wormwood.
About old gardens.

* **A. Abrotanum** Linnæus. Southernwood.
Pittsburgh, A. V. R. R., near Morningside, September, 1888, Dr. Ziegler.

* **A. biennis** Willdenow. Biennial wormwood.
Pittsburgh, Butler St., near 56th St., August, 1885.
Allegheny, Brighton Road. October, 1889.

SENECIO Linnæus.

† **S. vulgaris** Linnæus. Common groundsel.

* **S. aureus** Linnæus. Golden ragwort.

* **S. Balsamitæ** Muhlenberg. Balsam groundsel.

SYNOSMA Rafinesque.

CACALIA Linnæus.

* **S. suaveolens** (Linnæus). Sweet-scented Indian plantain.

MESADENIA Rafinesque.

CACALIA Linnæus.

* **M. reniformis** (Muhlenberg). Great Indian plantain.

* **M. atriplicifolia** (Linnæus). Pale Indian plantain.

ERECHTITES Rafinesque.

* **E. hieracifolia** (Linnæus). Fireweed.

ARCTIUM Linnæus.

† **A. Lappa** Linnæus. Great burdock.

* **A. minus** Schkuhr. Common burdock.

CARDUUS Linnæus.

CNICUS Tournefort.

* **C. lanceolatus** Linnæus. Common thistle.

* **C. altissimus** Linnæus. Roadside thistle.

* **C. discolor** (Muhlenberg). Field thistle.

* **C. odoratus** (Muhlenberg). Pasture thistle.
Fawn Township, roadside, Josiah Painter's place, July, 1895.

* **C. muticus** (Michaux). Swamp thistle.
Hampton Township, north of Wildwood Station, July, 1887, Dr. Adolph Koenig; August, 1890, J. A. S.

* **C. arvensis** (Linnæus). Canada thistle.

ONOPORDON Linnæus.

* **O. Acanthium** Linnæus. Cotton thistle.
Pittsburg, W. Carson St., near city lines, July, 1889–98.

CENTAUREA Linnæus.

* **C. Cyanus** Linnæus. Corn-flower.
Harrison and Moon Townships; escaped from gardens.

AMBROSIACEÆ Reichenbach.

RAGWEED FAMILY. V–42.

AMBROSIA Linnæus.

* **A. trifida** Linnæus. Great ragweed.

* **A. trifida integrifolia** (Muhlenberg). Entire-leaved great ragweed.

* **A. artemisiæfolia** Linnæus. Ragweed.

XANTHIUM Linnæus.

* **X. strumarium** Linnæus. Burweed.

CICHORIACEÆ Reichenbach.

CHICORY FAMILY. V–41.

ADOPOGON Necker.

KRIGIA Schreber.

* **A. Virginicum** (Linnæus). Virginia goatsbeard.
K. amplexicaulis Nuttall.

CICHORIUM Linnæus.

* **C. Intybus** Linnæus. Chicory.

HIERACIUM Linnæus.

† **H. Canadense** Michaux. Canada hawkweed.

* **H. paniculatum** Linnæus. Panicled hawkweed.

* **H. venosum** Linnæus. Rattlesnake-weed.

* **H. scabrum** Michaux. Rough hawkweed.

† **H. Gronovii** Linnæus. Hairy hawkweed.

NABALUS Cassini.

PRENANTHES Linnæus.

† **N. crepidineus** (Michaux). Corymbed rattlesnake-root.

* **N. albus** (Linnæus). White rattlesnake-root.

* **N. serpentarius** (Pursh). Lion's-foot.

* **N. altissimus** (Linnæus). Tall white lettuce.

† **N. trifoliatus** Cassini. Tall rattlesnake-root.

TARAXACUM Haller.

* **T. Taraxacum** (Linnæus). Common dandelion.
T. officinale Weber.

§ **T. erythrospermum** Andrzejowski. Red-seeded dandelion.

LACTUCA Linnæus.

* **L. Scariola** Linnæus. Prickly lettuce.

* **L. Canadensis** Linnæus. Wild lettuce.

* **L. sagittifolia** Elliott. Arrow-leaved lettuce.
L. integrifolia Bigelow.

* **L. hirsuta** Muhlenberg. Hairy wood-lettuce.

* **L. villosa** Jacquin. Hairy blue lettuce.
L. acuminata A. Gray.

* **L. spicata** (Lamarck). Tall blue lettuce.
L. leucophæa. A. Gray.

SONCHUS Linnæus.

* **S. oleraceus** Linnæus. Sow-thistle.

* **S. asper** (Linnæus). Spiny sow-thistle.

CAMPANULACEÆ Jussieu.

BELL-FLOWER FAMILY. V–40.

CAMPANULA Linnæus.

? **C. rotundifolia** Linnæus. Harebell.

* **C. aparinoides** Pursh. Marsh bell-flower.
Hulton, on river-bank, August, 1888, Dr. Adolph Koenig. Harrison Township, swamp below Joseph Johnston's house, August, 1900.

* **C. Americana** Linnæus. Tall bell-flower.

LEGOUZIA Durand.

SPECULARIA Heister.

* **L. perfoliata** (Linnæus). Venus' looking-glass.

LOBELIA Linnæus.

* **L. cardinalis** Linnæus. Cardinal-flower.
Pittsburg, Glenwood Grove, near river bank, Sept., 1882; Harrison Township, woods of Henry Boyd's heirs, Sept., 1900.

* **L. syphilitica** Linnæus. Great lobelia.

* **L. spicata** Lamarck. Spiked lobelia.

* **L. inflata** Linnæus. Indian tobacco.

VACCINIACEÆ Lindley.

HUCKLEBERRY FAMILY. V–5.

GAYLUSSACIA Humboldt, Bonpland, & Kunth.

* **G. resinosa** (Aiton). Black huckleberry.

VACCINIUM Linnæus.

* **V. stamineum** Linnæus. Deerberry.

† **V. corymbosum** Linnæus. Tall blueberry.

† **V. vacillans** Kalm. Low blueberry.

* **V. Pennsylvanicum** Lamarck. Dwarf blueberry.

ERICACEÆ DeCandolle.

HEATH FAMILY. V–4.

EPIGÆA Linnæus.

* **E. repens** Linnæus. Trailing arbutus.

GAULTHERIA Linnæus.

* **G. procumbens** Linnæus. Wintergreen.

XOLISMA Rafinesque.

ANDROMEDA Linnæus.

* **X. ligustrina** (Linnæus). Andromeda.
Pine Township. Creek near Wexford, June, 1886.

OXYDENDRUM De Candolle.

§ **O. arboreum** (Linnæus). Sorrel-tree.

KALMIA Linnæus.

* **K. latifolia** Linnæus. Mountain laurel.

RHODODENDRON Linnæus.

* **R. maximum** Linnæus. Great laurel.

AZALEA Linnæus.

* **A nudiflora** Linnæus. Wild honeysuckle.

* **A. arborescens** Pursh. Tree azalea.

PYROLACEÆ Agardh.

WINTERGREEN FAMILY. V–2.

CHIMAPHILA Pursh.

* **C. umbellata** (Linnæus). Pipsissewa.

* **C. maculata** (Linnæus). Spotted wintergreen.

PYROLA Linnæus.

† **P. chlorantha** Swartz. Greenish-flowered wintergreen.

* **P. elliptica** Nuttall. Shin-leaf.

* **P. rotundifolia** Linnæus. Round-leaved wintergreen.

MONOTROPACEÆ Lindley.

INDIAN-PIPE FAMILY. V–3.

MONOTROPA Linnæus.

* **M. uniflora** Linnæus. Indian-pipe.

HYPOPITYS Adanson.

* **H. Hypopitys** (Linnæus). Pine-sap.
Moon Township, McKee tract, July, 1887.

PRIMULACEÆ Ventenat.

PRIMROSE FAMILY. V–7.

TRIENTALIS Linnæus.

† **T. Americana** Pursh. Star-flower.

STEIRONEMA Rafinesque.

* **S. ciliatum** (Linnæus). Fringed loosestrife.

LYSIMACHIA Linnæus.

* **L. quadrifolia** Linnæus. Whorled loosestrife.

* **L. terrestris** (Linnæus). Bulbous loosestrife.
L. stricta Aiton.

* **L. Nummularia** Linnæus. Moneywort.
Sparingly escaped from old gardens.

ANAGALLIS Linnæus.

* **A. arvensis** Linnæus. Poor man's weather-glass.

EBENACEÆ Ventenat.

EBONY FAMILY. V–10.

DIOSPYROS Linnæus.

* **D. Virginiana** Linnæus. Persimmon.
Probably our rarest tree, found only in three or four stations.

OLEACEÆ Lindley.

OLIVE FAMILY. V–13.

FRAXINUS Linnæus.

* **F. Americana** Linnæus. White ash.

* **F. lanceolata** Borckhausen. Green ash.
F. viridis Michaux.

† **F. Pennsylvanica** Marshall. Red ash.
F. pubescens Lamarck.

? **F. quadrangulata** Michaux. Blue ash.

* **F. nigra** Marshall. Black ash.
F. sambucifolia Lamarck.
Stowe Township. Wet woods. Graham tract, Sept. 15, 1899.

LIGUSTRUM Linnæus.

* **L. vulgare** Linnæus. Privet.
Spontaneous about old gardens.

APOCYNACEÆ Lindley.

DOGBANE FAMILY. V–17.

APOCYNUM Linnæus.

* **A. androsæmifolium** Linnæus. Spreading dogbane.

* **A. cannabinum** Linnæus. Indian hemp.

* **A. cannabinum glaberrimum** De Candolle.

* **A. hypericifolium** Aiton. Clasping-leaved dogbane.
Penn Township, river bank, A. V. R. R., at mile-post 8, June, 1884.

VINCA Linnæus.

* **V. minor** Linnæus. Periwinkle.
Occasionally escaped near old graveyards.

ASCLEPIADACEÆ Lindley.

MILKWEED FAMILY. V–18.

ASCLEPIAS Linnæus.

* **A. tuberosa** Linnæus. Pleurisy-root.

* **A. incarnata** Linnæus. Swamp milkweed.

A white-flowering form, Moon Township, near Coraopolis, August, 1890.

* **A. Syriaca** Linnæus. Common milkweed.

A. Cornuti Decaisne.

* **A. exaltata** (Linnæus). Poke milkweed.

A. phytolaccoides Pursh.

† **A. variegata** Linnæus. White milkweed.

* **A. quadrifolia** Jacquin. Four-leaved milkweed.

ACERATES Elliott.

* **A. viridiflora** (Rafinesque). Green milkweed.

Moon Township, Shafer farm, July, 1887. Harrison Township, John Pott's farm, July, 1895.

GENTIANACEÆ Dumortier.

GENTIAN FAMILY. V–15.

SABBATIA Adanson.

* **S. angularis** (Linnæus). Rose-pink.

GENTIANA Linnæus.

* **G. crinita** Frœlich. Fringed gentian.

Shaler Township, Miller farm, July, 1886. Hon. J. D. Shafer.

* **G. Andrewsii** Grisebach. Closed gentian.

OBOLARIA Linnæus.

* **O. Virginica** Linnæus. Pennywort.

"Woods below Sewickley, 1868," Rev. S. W. Knipe. Moon Township, McKee tract, May 8, 1887.

POLEMONIACEÆ De Candolle.

PHLOX FAMILY. V–21.

PHLOX Linnæus.

† **P. paniculata** Linnæus. Garden phlox.

* **P. maculata** Linnæus. Wild Sweet-William.

* **P. divaricata** Linnæus. Wild blue phlox.

* **P. subulata** Linnæus. Moss-pink.

POLEMONIUM Linnæus.

* **P. reptans** Linnæus. Greek valerian.

HYDROPHYLLACEÆ.

WATER-LEAF FAMILY. V–22.

HYDROPHYLLUM Linnæus.

* **H. Virginicum** Linnæus. Virginia water-leaf.

* **H. Canadense** Linnæus. Broad water-leaf.

* **H. appendiculatum** Michaux. Appendaged water-leaf.

PHACELIA Jussieu.

* **P. Purshii** Buckley. Pursh's phacelia.

BORAGINACEÆ Lindley.

BORAGE FAMILY. V–23.

CYNOGLOSSUM Linnæus.

* **C. officinale** Linnæus. Hound's-tongue.

* **C. Virginicum** Linnæus. Wild comfrey.

LAPPULA Mœnch.

ECHINOSPERMUM Swartz.

* **L. Virginiana** (Linnæus). Beggar's-lice.

* **L. Lappula** (Linnæus). European burseed.

MERTENSIA Roth.

* **M. Virginica** (Linnæus). Bluebells.

MYOSOTIS Linnæus.

* **M. laxa** Lehmann. Smaller forget-me-not.

* **M. Virginica** (Linnæus). Early scorpion-grass.
M. verna Nuttall.

LITHOSPERMUM Linnæus.

* **L. arvense** Linnæus. Corn gromwell.

† **L. officinale** Linnæus. Gromwell.

* **L. latifolium** Michaux. American gromwell.
Pittsburg, hilltop near Salt-works Station, B. & O. R. R., 1891, Dr. A. Koenig.

ECHIUM Linnæus.

* **E. vulgare** Linnæus. Blueweed.

SYMPHYTUM Linnæus.

† **S. officinale** Linnæus. Comfrey.

CONVOLVULACEÆ Ventenat.

MORNING-GLORY FAMILY. V–19.

IPOMŒA Linnæus.

* **I. hederacea** Jacquin. Ivy-leaved morning-glory.
Moon Township, T. A. Shafer heirs' farm, Sept., 1887.

* **I. purpurea** (Linnæus). Morning-glory.
Often escaped to waste places.

* **I. pandurata** (Linnæus). Wild potato vine.

CONVOLVULUS Linnæus.

* **C. spithamæus** Linnæus. Upright bindweed.

* **C. sepium** Linnæus. Great bindweed.

* **C. Japonicus** Thunberg. Double morning-glory.
The double form occasionally escaped.

|| **C. arvensis** Linnæus. Small bindweed.

CUSCUTACEÆ Dumortier.

DODDER FAMILY. V–20.

CUSCUTA Linnæus.

* **C. Gronovii** Willdenow. Gronovius' dodder.

SOLANACEÆ Persoon.

NIGHTSHADE FAMILY. V–26.

SOLANUM Linnæus.

* **S. Dulcamara** Linnæus. Bittersweet.
Allegheny, Highwood Cemetery, in woods. John Ferguson.

* **S. nigrum** Linnæus. Black nightshade.

* **S. Carolinense** Linnæus. Horse-nettle.

PHYSALIS Linnæus.

*? **P. Philadelphica** Lamarck. Philadelphia ground-cherry.

*? **P. pubescens** Linnæus. Low hairy ground-cherry.

*? **P. heterophylla** Nees. Clammy ground-cherry.

? **P. viscosa** Linnæus. Stellate ground-cherry.

PHYSALODES Bœhmer.

NICANDRA Adanson.

* **P. Physalodes** (Linnæus). Apple-of-Peru.
Stowe Township, Davis Island Station, P. & L. E. R. R., Oct., 1885.

LYCIUM Linnæus.

* **L. vulgare** (Aiton, f.). Matrimony vine.

DATURA. Linnæus.

* **D. Stramonium** Linnæus. Jimson-weed.

* **D. Tatula** Linnæus. Purple thorn-apple.

LYCOPERSICON Miller.

* **L. Lycopersicon** (Linnæus). Tomato.
Frequently spontaneous about waste places in the city.

PETUNIA Jussieu.

* **P. axillaris** (Lamarck). White petunia.
Escaped from gardens.

* **P. violacea** Lindley. Violet petunia.
Escaped, more frequently than the last.

SCROPHULARIACEÆ Lindley.

FIGWORT FAMILY. V–27.

VERBASCUM Linnæus.

* **V. Thapsus** Linnæus. Velvet mullein.

* **V. Blattaria** Linnæus. Moth-mullein.

LINARIA Jussieu.

* **L. Linaria** (Linnæus). Toad-flax.
L. vulgaris Miller.

SCROPHULARIA Linnæus.

* **S. Marylandica** Linnæus. Figwort.

COLLINSIA Nuttall.

* **C. verna** Nuttall. Blue-eyed Mary.
Robinson Township, Scully's Springs, May, 1893, Prof. G. Guttenberg.

CHELONE Linnæus.

* **C. glabra** Linnæus. Turtle-head.

PENTSTEMON Solander.

* **P. hirsutus** (Linnæus). Hairy beard-tongue.
P. pubescens Solander.

* **P. Digitalis** (Sweet). Foxglove beard-tongue.

MIMULUS Linnæus.

* **M. ringens** Linnæus. Square-stemmed monkey-flower.

† **M. alatus** Solander. Winged monkey-flower.

GRATIOLA Linnæus.

* **G. Virginiana** Linnæus. Clammy hedge-hyssop.

† **G. aurea** Muhlenberg. Golden hedge-hyssop.

ILYSANTHES Rafinesque.

* **I. gratioloides** (Linnæus). False pimpernel.

LEPTANDRA Nuttall.

VERONICA Linnæus.

* **L. Virginica** (Linnæus). Culver's-root.

VERONICA Linnæus.

* **V. spicata** Linnæus. Spiked speedwell.
Moon Township, old orchard near Carnot, July, 1895.

† **V. Anagallis-aquatica** Linnæus. Water speedwell.

* **V. Americana** Schweinitz. American speedwell.

* **V. scutellata** Linnæus. Skull-cap speedwell.
Robinson Township, ditches near Groveton, June, 1898.

* **V. officinalis** Linnæus. Common speedwell.

* **V. serpyllifolium** Linnæus. Thyme-leaved speedwell.

* **V. peregrina** Linnæus. Purslane speedwell.

* **V. arvensis** Linnæus. Corn speedwell.

GERARDIA Linnæus.

* **G. tenuifolia** Vahl. Slender gerardia.

DASYSTOMA Linnæus.

GERARDIA Linnæus.

* **D. Pedicularia** (Linnæus). Fern-leaved false foxglove.
Moon Township, Wm. Tomlinson's woods, Aug., 1896.

* **D. flava** (Linnæus). Downy false foxglove.

† **D. lævigata** Rafinesque. Entire-leaved false foxglove.

CASTILLEJA Mutis.

* **C. coccinea** (Linnæus). Scarlet painted-cup.
Marshall Township, near Thorn Hill, May, 1886.

PEDICULARIS Linnæus.

* **P. Canadensis** Linnæus Wood betony.

OROBANCHACEÆ Lindley.

BROOM-RAPE FAMILY. V–29.

LEPTAMNIUM Rafinesque.

EPIPHEGUS Nuttall.

* **L. Virginianum** (Linnæus). Beech-drops.

CONOPHOLIS Wallroth.

* **C. Americana** (Linné). Squaw-root.

THALESIA Rafinesque.

APHYLLON A. Gray.

* **T. uniflora** (Linnæus). Cancer-root.

BIGNONIACEÆ Persoon.

TRUMPET-CREEPER FAMILY. V–30.

TECOMA Jussieu.

* **T. radicans** (Linnæus). Trumpet-creeper.
Moon Township, Deadman's Island, July, 1896.

CATALPA Scopoli.

* **C. Catalpa** (Linnæus). Indian bean.

C. bignonioides Walter.

Pittsburgh, Stanton Ave., spontaneous, frequently so elsewhere about the city.

ACANTHACEÆ St. Hilaire.

ACANTHUS FAMILY. V–32.

DIANTHERA Linnæus.

D. Americana Linnæus. Water willow.

VERBENACEÆ St. Hilaire.

VERVAIN FAMILY. V–24.

VERBENA Linnæus.

* **V. urticifolia** Linnæus. Nettle leaved vervain.

* **V. hastata** Linnæus. Blue vervain.

§ **V. stricta** Ventenat. Hoary vervain.

LIPPIA Linnæus.

* **L. lanceolata** Michaux. Frog-fruit.

Allegheny, "River bank, near glass-house ripple." John Ferguson.

PHRYMACEÆ Schauer.

LOPSEED FAMILY. V–32.*

PHRYMA Linnæus.

* **P. Leptostachya** Linnæus. Lopseed.

LABIATÆ B. Jussieu.

MINT FAMILY. V–25.

ISANTHUS Michaux.

* **I. brachiatus** (Linnæus). False pennyroyal.
I. cœruleus Michaux.

TEUCRIUM Linnæus.

* **T. Canadense** Linnæus. Wood sage.

COLLINSONIA Linnæus.

* **C. Canadensis** Linnæus. Stone-root.

MENTHA Linnæus.

* **M. rotundifolia** (Linnæus). Round-leaved mint.
Old gardens; occasionally spontaneous.

* **M. spicata** Linnæus. Spearmint.
M. viridis Linnæus.

* **M. piperita** Linnæus. Peppermint.

|| **M. crispa** Linnæus. Curled mint.

† **M. arvensis** Linnæus. Field mint.

* **M. Canadensis.** Wild mint.

LYCOPUS Linnæus.

* **L. Virginicus** Linnæus. Bugle-weed.

* **L. Americanus** Muhlenberg. Cut-leaved water horehound.
L. sinuatus Elliott.

† **L. Europæus** Linnæus. Water horehound.

PERILLA Arduino.

* **P. frutescens** (Linnæus). Perilla.
Pittsburgh; spontaneous in old gardens.

CUNILA Linnæus.

* **C. origanoides** (Linnæus). American dittany.
C. Mariana Linnæus.

KŒLLIA Mœnch.

PYCNANTHEMUM Michaux.

* **K. Virginiana** (Linnæus). Virginia mountain-mint.
P. lanceolatum Pursh.
Hulton, August 1, 1888. Dr. Adolph Koenig.

* **K. flexuosa** (Walker). Narrow-leaved mountain-mint.
P. linifolium Pursh.
Sterrett Township, near Edgewood, August, 1885. C. C. Mellor.

* **K. verticillata** (Michaux). Torrey's mountain-mint.
P. Torreyi Bentham.
Fawn Township, Branch of Bull Creek, near Schoolhouse No. 2, August, 1900.

* **K. incana** (Linnæus). Hoary mountain-mint.

CLINOPODIUM Linnæus.

CALAMINTHA Mœnch.

* **C. vulgare** Linnæus. Wild basil.
C. Clinopodium Bentham.

MELISSA Linnæus.

* **M. officinalis** Linnæus. Lemon balm.

HEDEOMA Persoon.

H. pulegioides (Linnæus). American pennyroyal.

SALVIA Linnæus.

† **S. lyrata** Linnæus. Lyre-leaved sage.

MONARDA Linnæus.

* **M. didyma** Linnæus. Oswego tea.

|| **M. media** Willdenow. Purple bergamot.
Moon Township, Flaugherty's Run, August, 1893.

* **M. fistulosa** Linnæus. Wild bergamot.

BLEPHILIA Rafinesque.

* **B. ciliata** (Linnæus). Downy blephilia.

* **B. hirsuta** (Pursh). Hairy blephilia.

AGASTACHE Clayton.

LOPHANTHUS Bentham.

* **A. nepetoides** (Linnæus). Catnip giant-hyssop.

* **A. scrophulariæfolius** (Willdenow). Figwort giant-hyssop.
Moon Township, thickets near Thorn Run Station, August, 1897, Oct., 1900.
Harrison Township, roadside near Sligo, Sept., 1900.

NEPETA Linnæus.

* **N. Cataria** Linnæus. Catnip.

GLECOMA Linnæus.

* **G. hederacea** Linnæus. Ground ivy.
Nepeta Glechoma Bentham.

MEEHANIA Britton.

CEDRONELLA Mœnch.

* **C. cordata** (Nuttall). Meehania.
Mifflin Township, Howard Station, June, 1893, Prof. G. Guttenberg.

PHYSOSTEGIA Bentham.

* **P. Virginiana** (Linnæus). False dragon-head.
Robinson Township, Moon Run Station, Sept. 11, 1886. Prof. B. H. Patterson.
Moon Township, Deadman's Island, July, 1896.

PRUNELLA Linnæus.

* **P. vulgaris** Linnæus. Heal-all.

SCUTELLARIA Linnæus.

* **S. lateriflora** Linnæus. Mad-dog skullcap.

* **S. saxatilis** Riddell. Rock skullcap.
Moon Township, Laschell's Hollow ; August 1, 1898.

* **S. incana** Muhlenberg. Downy skullcap.
S. canescens Nuttall.

* **S. pilosa** Michaux. Hairy skullcap.
O'Hara Township, Darlington's Hollow, August 17, 1884.

* **S. parvula** Michaux. Small skullcap.

† **S. galericulata** Linnæus. Marsh skullcap.

* **S. nervosa** Pursh. Veined skullcap

MARRUBIUM Linnæus.

* **M. vulgare** Linnæus. Hoarhound.

Moon Township, roadside near Carnot, August, 1898.

Fawn Township, roadside near Bull Creek, near Tarentum, August, 1900.

LEONURUS Linnæus.

* **L. Cardiaca** Linnæus. Motherwort.

GALEOPSIS Linnæus.

† **G. Tetrahit** Linnæus. Hemp-nettle.

STACHYS Linnæus.

* **S. palustris** Linnæus. Hedge-nettle.

Hampton Township, Wildwood Station, July 9, 1891, Dr. Adolph Koenig.

† **S. aspera** Michaux. Rough hedge-nettle.

LAMIUM Linnæus.

* **L. amplexicaule** Linnæus. Henbit dead-nettle.

* **L. maculatum** Linnæus. Spotted dead-nettle.

Old gardens, occasionally spontaneous.

PLANTAGINACEÆ Lindley.

PLANTAIN FAMILY. V–33.

PLANTAGO Linnæus.

* **P. major** Linnæus. Common plantain.

Not so common as the next.

* **P. Rugelii** Decaisne. Rugel's plantain.

* **P. lanceolata** Linnæus. English plantain.

* **P. aristata** Michaux. Large-bracted plantain.

* **P. Virginica** Linnæus. Dwarf plantain.

AMARANTHACEÆ J. St. Hilaire.

AMARANTH FAMILY. IV–16.

AMARANTHUS Linnæus.

* **A. hybridus** Linnæus. Slender pigweed.
A. chlorostachys Willdenow.

* **A. hybridus paniculatus** (Linnæus). Red pigweed.

* **A. retroflexus** Linnæus. Rough pigweed.

† **A. græcizans** Linnæus. Tumble-weed.
A. albus Linnæus.

* **A. blitoides** Watson. Prostrate amaranth.

CHENOPODIACEÆ Dumortier.

GOOSEFOOT FAMILY. IV–15.

CHENOPODIUM Linnæus.

* **C. album** Linnæus. Lamb's quarters.

* **C. glaucum** Linnæus. Oak-leaved goosefoot.
Harrison Township, streets of Natrona, August, 1895–1900.

* **C. urbicum** Linnæus. City goosefoot.

† **C. hybridum** Linnæus. Maple-leaved goosefoot.
Rev. S. W. Knipe, 1869?

* **C. Bonus-Henricus** Linnæus. Good King Henry.

* **C. Botrys** Linnæus. Jerusalem oak.

* **C. ambrosioides** Linnæus. Mexican tea.

* **C. anthelminticum** Linnæus. Wormseed.

BLITUM Linnæus.

† **B. capitatum** Linnæus. Strawberry blite.

ATRIPLEX Linnæus.

† **A. patula** Linnæus. Spreading orache.

* **A. hastata** Linnæus. Halberd-leaved orache.

† **A. rosea** Linnæus. Red orache.

SALSOLA Linnæus.

* **S. Tragus** Linnæus. Russian thistle.
Harrison Township, Natrona. July, 1895.

PHYTOLACCACEÆ Lindley.

POKEWEED FAMILY. IV–17.

PHYTOLACCA Linnæus.

* **P. decandra** Linnæus. Pokeweed.

POLYGONACEÆ Lindley.

BUCKWHEAT FAMILY. IV–14.

RUMEX Linnæus.

* **R. Acetosella** Linnæus. Sheep sorrel.

† **R. verticillatus** Linnæus. Swamp dock.

* **R. crispus** Linnæus. Curled dock.

* **R. obtusifolius** Linnæus. Bitter dock.

† **R. conglomeratus** Murray. Smaller green dock.

† **R. sanguineus** Linnæus. Red veined dock.

POLYGONUM Linnæus.

? **P. maritimum** Linnæus. Seaside knotweed.

* **P. aviculare** Linnæus. Door-weed.

* **P. erectum** Linnæus. Erect knotweed.

* **P. ramosissimum** Michaux. Bushy knotweed.
Allegheny R. R. near outer depot, 1886, Dr. A. Ziegler.

† **P. incarnatum** Elliott. Slender pink persicaria.

* **P. Pennsylvanicum** Linnæus. Pennsylvania persicaria.

* **P. orientale** Linnæus. Prince's feather.

* **P. Persicaria** Linnæus. Lady's thumb.

* **P. hydropiperoides** Michaux. Mild waterpepper.

* **P. Hydropiper** Linnæus. Smart-weed.

* **P. punctatum** Elliott. Water smart-weed.
P. acre Humboldt, Bonpland & Kunth.

|| **P. emersum** (Michaux). Swamp persicaria.
Davis Island. Shore at head of island, August, 1898.

* **P. Virginianum** Linnæus. Virginia knotweed.

* **P. arifolium** Linnæus. Halberd-leaved tear-thumb.
Stowe Township, swamp near Turner Station, Sept. 15, 1899.

* **P. sagittatum** Linnæus. Arrow-leaved tear-thumb.

* **P. convolvulus** Linnæus. Black bindweed.

* **P. scandens** Linnæus. Climbing false buckwheat.

* **P. cilinode** Michaux. Fringed black bindweed.

FAGOPYRUM Gærtner.

* **F. Fagopyrum** (Linnæus). Buckwheat.

ARISTOLOCHIACEÆ Blume.

BIRTHWORT FAMILY. IV–13.

ASARUM Linnæus.

* **A. Canadense** Linnæus. Wild ginger.
Moon Township, among rocks, Laschell's Hollow, April 20, 1899.

* **A. reflexum** Bicknell. Short-lobed wild ginger.
Our commonest form, seems to belong here.

ARISTOLOCHIA Linnæus.

* **A. Serpentaria** Linnæus. Virginia snakeroot.

* **A. macrophylla** Lamarck. Dutchman's pipe.
A. Sipho L'Heritier.

"This grows naturally near Pittsburgh in a rich soil and shaded situation." Humphrey Marshall, in "Arbustum Americanum," 1785.

Wooded hillside, south bank of Ohio River, 1884–1900, J. A. S.

SAURURACEÆ Lindley.

LIZARD'S-TAIL FAMILY. IV–1.

SAURURUS Linnæus.

* **S. cernuus** Linnæus. Lizard's-tail.

LAURACEÆ Lindley.

LAUREL FAMILY. IV–30.

SASSAFRAS Nees & Ebermaier.

* **S. Sassafras** (Linnæus). Sassafras.
S. officinale Nees & Ebermaier.

BENZOIN Fabricius.

LINDERA Thunberg.

* **B. Benzoin** (Linnæus). Spice-bush.

SANTALACEÆ R. Brown.

SANDALWOOD FAMILY. IV–12.

COMANDRA Nuttall.

* **C. umbellata** (Linnæus). Bastard toad-flax.

LORANTHACEÆ D. Don.

MISTLETOE FAMILY. IV–11.

PHORADENDRON Nuttall.

† **P. flavescens** (Pursh). American mistletoe.

On an old oak which used to stand on the campus of the Western University of Pennsylvania, Allegheny, Dr. W. J. Holland.

EUPHORBIACEÆ J. St. Hilaire.

SPURGE FAMILY. IV–57.

EUPHORBIA Linnæus.

* **E. maculata** Linnæus. Spotted spurge.

* **E. nutans** Lagasca. Large spotted spurge.
E. Preslii Gussone.

* **E. corollata** Linnæus. Flowering spurge.

* **E. Peplus** Linnæus. Petty spurge.
Harrison Township, near Upper Schoolhouse No. 1, August, 1895–1900.

* **E. commutata** Engelmann. Tinted spurge.
South Fayette Township, near Marshalsea, May 11, 1900.

* **E. Cyparissias** Linnæus. Cypress spurge.
Frequently escaped from old graveyards.

ACALYPHA Linnæus.

* **A. Virginica** Linnæus. Three-seeded Mercury.

ULMACEÆ Mirbel.

ELM FAMILY. IV–8.

ULMUS Linnæus.

* **U. fulva** Michaux. Slippery, or red elm.

* **U. Americana** Linnæus. American, or white elm.

* **U. racemosa** Thomas. Cork, or rock elm.
Allegheny, Highwood Cemetery; apparently native.

CELTIS Linnæus.

* **C. occidentalis** Linnæus. Hackberry.

MORACEÆ Lindley.

MULBERRY FAMILY. IV–9.

CANNABIS Linnæus.

* **C. sativa** Linnæus.
Pittsburgh, occasionally, in waste places.

HUMULUS Linnæus.

* **H. Lupulus** Linnæus. Hop.
Doubtfully native.

TOXYLON Rafinesque.

MACLURA Nuttall.

* **T. pomiferum** Rafinesque. Osage orange.
M. aurantiaca Nuttall.
Escaped from hedges.

MORUS Linnæus.

* **M. rubra** Linnæus. Red mulberry.

* **M. alba** Linnæus. White mulberry.
Moon Township, two trees by fence-row, Wm. Tomlinson's, 1890.

URTICACEÆ Reichenbach.

NETTLE FAMILY. IV–10.

URTICA Linnæus.

* **U. gracilis** Aiton. Slender nettle.

† **U. dioica** Linnæus. Stinging nettle.

URTICASTRUM Fabricius.

LAPORTEA Gaudichaud.

* **U. divaricatum** (Linnæus). Wood nettle.
L. Canadensis Gaudichaud.

ADICEA Rafinesque.

PILEA Lindley.

* **A. pumila** (Linnæus). Clearweed.

PLATANACEÆ Lindley.

PLANE-TREE FAMILY. IV–42.

PLATANUS Linnæus.

* **P. occidentalis** Linnæus. Sycamore.

JUGLANDACEÆ Lindley.

WALNUT FAMILY. IV–2.

JUGLANS Linnæus.

* **J. cinerea** Linnæus. Butternut.

* **J. nigra** Linnæus. Black walnut.

HICORIA Rafinesque.

CARYA Nuttall.

* **H. ovata** (Miller). Shell-bark.
C. alba Nuttall.

† **H. laciniosa** (Michaux f.). Big shell-bark.
C. sulcata Nuttall.

* **H. alba** (Linnæus). Bull-nut.
C. tomentosa Nuttall.

† **H. odorata** (Marshall). Small-fruited hickory.
C. microcarpa Nuttall.

* **H. glabra** (Miller). Pig-nut.
C. porcina Nuttall.

* **H. minima** (Marshall). Bitter-nut.
C. amara Nuttall.

BETULACEÆ Agardh.

BIRCH FAMILY. IV-6.

BETULA Linnæus.

* **B. lenta** Linnæus. Sweet birch.

† **B. lutea** Michaux f. Yellow birch.

ALNUS Gærtner.

* **A. rugosa** (DuRoi). Smooth alder.
A. serrulata Willdenow.

CORYLUS Linnæus.

* **C. Americana** Walker. Hazel-nut.

OSTRYA Scopoli.

* **O. Virginiana** (Miller). Hop-tree.

CARPINUS Linnæus.

* **C. Caroliniana** Walter. American iron-wood.

FAGACEÆ Drude.

BEECH FAMILY. IV-7.

QUERCUS Linnæus.

* **Q. alba** Linnæus. White oak.

† **Q. minor** (Marshall). Post oak.
Q. stellata Wangenheim.

* **Q. macrocarpa** Michaux. Mossy-cup oak.
McKees Rocks, on Creek near Schoolhouse.

* **Q. platanoides** Lamarck. Swamp white oak.
Q. bicolor Willdenow.
Stowe Township, low woods on Graham place, Sept. 15, 1899.

* **Q. Prinus** Linnæus. Rock chestnut oak.

† **Q. acuminata** (Michaux). Yellow oak.
Q. Muhlenbergii Engelmann.

† **Q. prinoides** Willdenow. Chestnut scrub-oak.
Richland Township, near Bakerstown. Hon. J. D. Shafer.

* **Q. rubra** Linnæus. Red oak.

* **Q. coccinea** Wangenheim. Scarlet oak.

* **Q. velutina** Lamarck. Black oak.
Q. tinctoria Gray.

* **Q. palustris** DuRoi. Pin oak.

? **Q. digitata** (Marshall). Spanish oak.
Q. falcata Michaux.

† **Q. nana** (Marshall). Bear scrub oak.
Q. ilicifolia Wangenheim.

† **Q. Marylandica** Muenchausen. Barren oak.
Q. nigra Linnæus.

* **Q. imbricaria** Michaux. Laurel oak.

? **Q. Phellos** Linnæus. Willow oak.

CASTANEA Adanson.

* **C. dentata** (Marshall). Chestnut.

FAGUS Linnæus.

* **F. Americana** Sweet. American beech.

SALICACEÆ Lindley.

WILLOW FAMILY. IV–5.

SALIX Linnæus.

* **S. nigra** Marshall. Black willow.

† **S. lucida** Muhlenberg. Shining willow.

† **S. fragilis** Linnæus. Crack willow.

† **S. alba** Linnæus. White willow.

|| **S. Babylonica** Tournefort. Weeping willow.

* **S. fluviatilis** Nuttall. Sand-bar willow.
S. longifolia Marshall.

* **S. discolor** Muhlenberg. Glaucous willow.

? **S. humilis** Marshall. Prairie willow.

* **S. sericea** Marshall. Silky willow.

† **S. purpurea** Linnæus. Purple willow.

† **S. cordata** Muhlenberg. Heart-leaved willow.

POPULUS Linnæus.

* **P. alba** Linnæus. Silver-leaf poplar.
Escaped to roadsides.

* **P. tremuloides** Michaux. American aspen.
Harrison Township, between farms of John Potts and Jos. Johnston, 1895–1900.

* **P. grandidentata** Michaux. Large-toothed aspen.

* **P. balsamifera** Linnæus. Balsam poplar.

* **P. dilatata** Linnæus. Lombardy poplar.

CERATOPHYLLACEÆ A. Gray.

HORNWORT FAMILY. IV–23.

CERATOPHYLLUM Linnæus.

† **C. demersum** Linnæus. Hornwort.
Pittsburgh, Silver Lake, 1885. C. C. Mellor.

PINACEÆ Lindley.

PINE FAMILY. II–1.

PINUS Linnæus.

* **P. Strobus** Linnæus. White pine.

* **P. Virginiana** Miller. Scrub pine.
P. inops Aiton.

TSUGA Carriere.

* **T. Canadensis** (Linnæus). Hemlock.

JUNIPERUS Linnæus.

* **J. Virginiana** Linnæus. Red cedar.

TAXACEÆ Lindley.

YEW FAMILY. II–2.

TAXUS Linnæus.

|| **T. minor** (Michaux). American yew.
T. Canadensis Willdenow.
Shaler Township, R. R. tunnel near Undercliff.

ORCHIDACEÆ Lindley.

ORCHID FAMILY. III–28.

LEPTORCHIS Thouans.

LIPARIS L. C. Richard.

* **L. liliifolia** (Linnæus). Large twayblade.
Moon Township, several stations, 1890. Allegheny, Highwood Cemetery, June, 1891. John Ferguson.

APLECTRUM Nuttall.

* **A. spicatum** (Walter). Putty-root.
A. hyemale Nuttall.
Moon Township, Owen Evans' woods, June, 1887.

CORALLORHIZA R. Brown.

* **C. odontorhiza** (Willdenow). Small-flowered coral-root.
Moon Township, oak woods, T. A. Shafer heirs, August, 1889.

* **C. multiflora** Nuttall. Large coral-root.

GYROSTACHYS Persoon.

SPIRANTHES L. C. Richard.

* **G. cernua** (Linnæus). Nodding ladies' tresses.

* **G. gracilis** (Bigelow). Slender ladies' tresses.
Allegheny, Highwood Cemetery, August, 1898, John Ferguson.

PERAMIUM Salisbury.

GOODYERA R. Brown.

* **P. pubescens** (Willdenow). Downy rattlesnake plantain.

POGONIA Jussieu.

* **P. verticillata** (Willdenow). Whorled pogonia.
Moon Township, the McKee tract, in fruit, July, 1887.

ORCHIS Linnæus.

* **O. spectabilis** Linnæus. Showy orchis.

HABENARIA Willdenow.

* **H. orbiculata** (Pursh). Round-leaved orchis.
Moon Township, the McKee tract, July, 1887.

* **H. lacera** (Michaux). Ragged orchis.

* **H. peramœna** A. Gray. Fringeless purple orchis.
Moon Township, near Thorn Run Station, August, 1898.

CYPRIPEDIUM Linnæus.

* **C. hirsutum** Miller. Large yellow ladies' slipper.
C. pubescens Willdenow.

* **C. acaule** Aiton. Moccasin-flower.
Moon Township, McKee tract, in fruit, September, 1888.

IRIDACEÆ Lindley.

IRIS FAMILY. III–25.

IRIS Linnæus.

* **I. versicolor** Linnæus. Large blue flag.

* **I. cristata** Aiton.
Robinson Township, hillside, near Brightwood Station.

GEMMINGIA Fabricius.

BELAMCANDA Adanson.

* **G. Chinensis** (Linnæus). Blackberry lily.
Moon Township. Escaped from gardens.

SISYRINCHIUM Linnæus.

* **S. angustifolium** Miller. Pointed blue-eyed grass.
Allegheny, Highwood Cemetery, October, 1889, John Ferguson.

* **S. graminoides** Bicknell. Stout blue-eyed grass.

AMARYLLIDACEÆ Lindley.

AMARYLLIS FAMILY. III–23.

HYPOXIS Linnæus.

* **H. hirsuta** (Linnæus). Star-grass.
H. erecta Linnæus.

DIOSCOREACEÆ Lindley.

YAM FAMILY. III–24.

DIOSCOREA Linnæus.

* **D. villosa** Linnæus. Wild yam.

SMILACEÆ Ventenat.

SMILAX FAMILY. III–21.

SMILAX Linnæus.

* **S. herbacea** Linnæus. Carrion-flower.

* **S. rotundifolia** Linnæus. Common greenbrier.

* **S. glauca** Walter. Glaucous greenbrier.
Moon Township, Wm. Scott's farm, Nov. 10, 1899.

† **S. hispida** Muhlenberg. Hispid greenbrier.

LILIACEÆ Adanson.

LILY FAMILY. III–19.

ALLIUM Linnæus.

* **A. tricoccum** Aiton. Wild leek.

South Fayette Township, near Herriotsville, May, 1871–1900. Rev. S. W. Knipe.

Moon Township, J. J. Miller's Hollow, May, 1887–1899.

* **A. cernuum** Roth. Wild onion.

* **A. Canadense** Linnæus. Wild garlic.

Pittsburgh, near Salt-works Station, June, 1887. Prof. B. H. Patterson.

* **A. vineale** Linnæus. Field garlic.

Robinson Township, field opposite Groveton Station, July, 1899.

ORNITHOGALUM Linnæus.

* **O. umbellatum** Linnæus. Star of Bethlehem.

Moon Township, margin of woods, Evans' farm, May, 1896.

O'Hara Township, railroad embankment near Squaw Run, May, 1900.

QUAMASIA Rafinesque.

SCILLA Linnæus.

† **Q. hyacinthina** (Rafinesque). Wild hyacinth.

S. Fraseri A. Gray.

South Fayette Township, near Herriotsville, May, 1871, Rev. S. W. Knipe.

HEMEROCALLIS Linnæus.

* **H. fulva** Linnæus. Common day lily.

Commonly escaped to roadsides near dwellings.

ERYTHRONIUM Linnæus.

* **E. Americanum** Kerr. Yellow adder's-tongue, or dog's-tooth violet.

* **E. albidum** Nuttall. White adder's-tongue, or dog's-tooth violet.

LILIUM Linnæus.

† **L. Philadelphicum** Linnæus. Philadelphia lily.

* **L. superbum** Linnæus. Turkscap lily.

* **A. Canadense** Linnæus. Canada lily.

CONVALLARIACEÆ Link.

LILY-OF-THE-VALLEY FAMILY. III-20.

ASPARAGUS Linnæus.

* **A. officinalis** Linnæus. Asparagus.

POLYGONATUM Adanson.

* **P. biflorum** (Walter). Hairy Solomon's seal.

* **P. commutatum** (Rœmer & Schultes). Smooth Solomon's seal.
P. giganteum Dietrich.

VAGNERA Adanson.

SMILACINA Desfontaine.

* **V. racemosa** (Linnæus). False Solomon's seal.

UNIFOLIUM Adanson.

MAIANTHEMUM Wiggers.

* **U. Canadense** (Desfontaine). False lily-of-the-valley.

DISPORUM Salisbury.

PROSARTES Don.

† **D. lanuginosum** (Michaux). Hairy disporum.

STREPTOPUS Michaux.

§ **S. amplexifolius** (Linnæus). Clasping twisted-stalk.

CLINTONIA Rafinesque.

* **C. umbellulata** (Michaux). White clintonia.

MEDEOLA Linnæus.

* **M. Virginiana** Linnæus. Indian cucumber-root.

TRILLIUM Linnæus.

* **T. sessile** Linnæus. Sessile wake-robin.

* **T. nivale** Riddell. Early wake-robin.
Lower St. Clair Township, Sawmill Run, at Jackson's Hollow, April, 1886.

* **T. grandiflorum** (Michaux). Large-flowered wake-robin.

* **T. erectum** Linnæus. Fetid wake-robin.
The white form is less common.

§ **T. undulatum** Willdenow. Painted wake-robin.
T. erythrocarpum Michaux.

MELANTHACEÆ R. Brown.

BUNCH-FLOWER FAMILY. III–18.

UVULARIA Linnæus.

* **U. perfoliata** Linnæus. Perfoliate bellwort.

* **U. grandiflora** J. E. Smith. Large-flowered bellwort.

* **U. sessilifolia** Linnæus. Sessile-leaved bellwort.

CHAMÆLIRIUM Willdenow.

* **C. luteum** (Linnæus). Blazing-star.
C. Carolinianum Willdenow.

STENANTHIUM Kunth.

* **S. robustum** S. Watson. Stout stenanthium.
Richland Township, near Gibsonia, August, 1900.

MELANTHIUM Linnæus.

* **M. Virginicum** Linnæus. Bunch-flower.
Fawn Township, Branch of Bull Creek, Thos. Dixon's, July, 1896.

VERATRUM Linnæus.

* **V. viride** Aiton. White hellebore.
Pine Township, Pine Creek, near Wexford, June, 1886.

COMMELINACEÆ Reichenbach.

SPIDERWORT FAMILY. III–15.

COMMELINA Linnæus.

* **C. Virginica** Linnæus. Virginia day-flower.

TRADESCANTIA Linnæus.

* **T. Virginiana** Linnæus. Spiderwort.
Marshall Township, wet field, near Thorn Hill P. O., June, 1896.

JUNCACEÆ Ventenat.

RUSH FAMILY. III–17.

JUNCUS Linnæus.

* **J. effusus** Linnæus. Common soft rush.

* **J. tenuis** Willdenow. Bath-grass.

† **J. bufonius** Linnæus. Toad rush.

* **J. acuminatus** Michaux. Sharp-fruited rush.

* **J. Canadensis** J. Gay. Canada rush.

? **J. Cæsariensis** Coville. New Jersey rush.
J. asper Engelmann.

JUNCOIDES Adanson.
LUZULA De Candolle.

* **J. campestre** (Linnæus). Common wood-rush.

† **J. pilosum** (Linnæus). Hairy wood-rush.

TYPHACEÆ J. St. Hilaire.

CAT-TAIL FAMILY. III–1.

TYPHA Linnæus.

* **T. latifolia** Linnæus. Cat-tail.

SPARGANIACEÆ Agardh.

BURREED FAMILY. III–2.

SPARGANIUM Linnæus.

† **S. eurycarpum** Engelmann. Broad-fruited bur-reed.

† **S. simplex** Hudson. Simple-stemmed bur-reed.

ARACEÆ Necker.

ARUM FAMILY. III–9.

ARISÆMA Martens.

* **A. triphyllum** (Linnæus). Indian turnip.

* **A. Dracontium** (Linnæus). Green dragon.
Sterrett Township, low woods near C. C. Mellor's place, July, 1886.

CALLA Linnæus.

§ **C. palustris** Linnæus. Water arum.

SPATHYEMA Rafinesque.

SYMPLOCARPUS Salisbury.

* **S. fœtida** (Linnæus). Skunk cabbage.

ACORUS Linnæus.

* **A. Calamus** Linnæus. Calamus-root.

LEMNACEÆ Dumortier.

DUCKWEED FAMILY. III–10.

LEMNA Linnæus.

† **L. minor** Linnæus. Lesser duckweed.

† **L. trisulca** Linnæus. Star duckweed.

VALLISNERIACEÆ Dumortier.

TAPE-GRASS FAMILY. III–6.

VALLISNERIA Linnæus.

* **V. spiralis** Linnæus. Tape-grass.
O'Hara Township, Allegheny River above Aspinwall, September 20, 1899.

ALISMACEÆ De Candolle.

WATER-PLANTAIN FAMILY. III–5.

ALISMA Linnæus.

* **A. Plantago-aquatica** Linnæus. Water-plantain.

SAGITTARIA Linnæus.

* **S. latifolia** Willdenow. Broad arrow-leaf.
S. variabilis Engelmann.

NAIADACEÆ Lindley.

PONDWEED FAMILY. III–3.

POTAMOGETON Linnæus.

* **P. natans** Linnæus. Common floating pondweed.

CYPERACEÆ J. St. Hilaire.

SEDGE FAMILY. III–8.

CYPERUS Linnæus.

* **C. flavescens** Linnæus. Yellow cyperus.

* **C. diandrus** Torrey. Low cyperus.

* **C. rivularis** Kunth. Shining cyperus.

† **C. strigosus** Linnæus. Straw-colored cyperus.

* **C. speciosus** Vahl. Michaux's cyperus.

ELEOCHARIS R. Brown.

* **E. ovata** (Roth). Ovoid spike-rush.

† **E. palustris** (Linnæus). Creeping spike-rush.

* **E. tenuis** (Willdenow). Slender spike-rush.

SCIRPUS Linnæus.

* **S. lacustris** Linnæus. Great bulrush.

* S. **atrovirens** Muhlenberg. Dark bulrush.

* S. **polyphyllus** Vahl. Leafy bulrush.

* S. **lineatus** Michaux. Reddish bulrush.

* S. **cyperinus** (Linnæus). Wool-grass.

CAREX Linnæus.

§ C. **intumescens** Rudge. Bladder sedge.

* C. **Asa-Grayi** Bailey. Gray's sedge.

† C. **lupulina** Muhlenberg. Hop sedge.

† C. **lurida** Wahlenberg. Sallow sedge.

* C. **squarrosa** Linnæus. Squarrose sedge.

* C. **scabrata** Schweinitz. Rough sedge.

† C. **stricta** Lamarck. Tussock sedge.

† C. **torta** Boott. Twisted sedge.

* C. **prasina** Wahlenberg. Dropping sedge.

† C. **limosa** Linnæus. Mud sedge.

† C. **crinita** Lamarck. Fringed sedge.

§ C. **gynandra** Schweinitz. Nodding sedge.

* C. **virescens** Muhlenberg. Downy green sedge.

* C. **costellata** Britton. Ribbed sedge.
C. virescens var. *costata* Dewey.

* C. **triceps** Michaux. Hirsute sedge.

* C. **gracillima** Schweinitz. Graceful sedge.

† C. **grisea** Wahlenberg. Gray sedge.

* C. **glaucodea** Tuckerman. Glaucescent sedge.

* C. **granularis** Muhlenberg. Meadow sedge.

† C. **granularis Shriveri** Britton. Shriver's meadow sedge.
C. granularis var. *Haleana* Porter not *C. Halei* Dewey.

† C. **flava** Linnæus. Yellow sedge.

† C. **Hitchcockiana** Dewey. Hitchcock's sedge.

† C. **laxiflora** Lamarck. Loose-flowered sedge.

† C. **laxiflora patulifolia** (Dewey). Loose flowered sedge.

† C. **Careyana** Torrey. Carey's sedge.

* C. **Albursina** Sheldon. White-bear sedge.
C. laxiflora var. *latifolia* Boott.

† C. **plantaginea** Lamarck. Plantain-leaved sedge.

† C. **platyphylla** Carey. Broad-leaved sedge.

† C. **Pennsylvanica** Lamarck. Pennsylvania sedge.

* C. **varia** Muhlenberg. Emmons' sedge.

* C. **pubescens** Muhlenberg. Pubescent sedge.

* C. **Jamesii** Schweinitz. James' sedge.

* C. **stipata** Muhlenberg. Awl-fruited sedge.

* C. **vulpinoidea** Michaux. Fox sedge.

† C. **rosea** Schkuhr. Stellate sedge.

* C. **retroflexa** Muhlenberg. Reflexed sedge.

† C. **sparganioides** Muhlenberg. Bur-reed sedge.

* C. **cephalophora** Muhlenberg. Oval-headed sedge.

† C. **Muhlenbergii** Schkuhr. Muhlenberg's sedge.

* C. **tribuloides** Wahlenberg. Blunt broom sedge.

† C. **scoparia** Schkuhr. Pointed broom sedge.

GRAMINEÆ Jussieu.

GRASS FAMILY. III–7.

SPARTINA Schreber.

* S. **cynosuroides** (Linnæus). Tall marsh-grass.

SYNTHERISMA Walter.
PANICUM Linnæus.

* **C. linearis** (Krock). Small crab-grass.
P. glabrum Gaudin.

* **S. sanguinalis** (Linnæus). Large crab-grass.
P. sanguinale Linnæus.

PANICUM Linnæus.

† **P. proliferum** Lamarck. Spreading panicum.

† **P. capillare** Linnæus. Witch grass.

† **P. virgatum** Linnæus. Tall smooth panicum.

† **P. Porterianum** Nash. Porter's panicum.
P. latifolium Walter.

† **P. clandestinum** Linnæus. Hispid panicum.

? **P. commutatum** Schultes. Variable panicum.

† **P. depauperatum** Muhlenberg. Starved panicum.

* **P. pubescens** Lamarck. Hairy panicum.

† **P. dichotomum** Linnæus. Forked panicum.

† **P. laxiflorum** Lamarck. Lax-flowered panicum.

* **P. Crus-galli** Linnæus. Cockspur grass.

IXOPHORUS Schlechtendal.
SETARIA Beauvois.

* **I. verticillatus** (Linnæus). Foxtail-grass.

† **I. glaucus** (Linnæus). Yellow foxtail.

† **I. viridis** (Linnæus). Bottle-grass.

* **I. Italicus** (Linnæus). Hungarian millet.

CENCHRUS Linnæus.

* **C. tribuloides** (Linnæus). Bur-grass.

HOMALOCENCHRUS Mieg.

LEERSIA Swartz.

† **H. Virginicus** (Willdenow). White grass.

† **H. oryzoides** (Linnæus). Rice cut-grass.

ANDROPOGON Linnæus.

* **A. furcatus** Muhlenberg. Forked beard-grass.

* **A. scoparius** Michaux. Broom beard-grass.

CHRYSOPOGON Trinius.

* **C. avenaceus** (Michaux). Indian grass.
C. nutans A. Gray.

PHALARIS Linnæus.

* **P. Canariensis** Linnæus. Canary-grass.
Occasionally about rubbish heaps.

* **P. arundinacea** Linnæus. Reed canary-grass.
The variegated form occasionally escaped from near-by gardens.

ANTHOXANTHUM Linnæus.

† **A. odoratum** Linnæus. Sweet vernal-grass.

MUHLENBERGIA Schreber.

* **M. Mexicana** (Linnæus). Meadow muhlenbergia.

† **M. tenuiflora** (Willdenow). Slender muhlenbergia.

* **M. diffusa** Schreber. Dropseed grass.

BRACHYELYTRUM Schreber.

† **B. erectum** (Schreber). Brachyelytrum.

PHLEUM Linnæus.

* **P. pratense** Linnæus. Timothy.

ALOPECURUS Linnæus.

* **A. pratensis** Linnæus. Meadow foxtail.

SPOROBOLUS R. Brown.

* **S. vaginæflorus** (Torrey). Rush-grass.

AGROSTIS Linnæus.

* **A. alba** Linnæus. Red-top.

† **A. perennans** (Walter). Thin-grass.

† **A. hyemalis** (Walter). Hair-grass.

CINNA Linnæus.

† **C. arundinacea** Linnæus. Wood reed-grass.

ARRHENATHERUM Beauvois.

† **A. elatius** (Linnæus). Oat-grass.

HOLCUS Linnæus.

* **H. lanatus** Linnæus. Velvet-grass.

DESCHAMPSIA Beauvois.

† **D. cæspitosa** (Linnæus). Tufted hair-grass.

AVENA Linnæus.

* **A. sativa** Linnæus. Common oats.
Abundantly spontaneous.

DANTHONIA De Candolle.

* **D. spicata** (Linnæus). Wild oat-grass.

ELEUSINE Gærtner.

* **E. Indica** (Linnæus). Yard-grass.

EATONIA Rafinesque.

† **E. obtusata** (Michaux). Blunt eatonia.

† **E. Pennsylvanica** (De Candolle). Pennsylvania eatonia.

† **E. nitida** (Sprengel). Slender eatonia.
E. Dudleyi Veasey.
Near Pittsburgh, Pa.; Wm. R. Dudley, in Cayuga Flora, p. 127.

ERAGROSTIS Beauvois.

* **E. hypnoides** (Lamarck). Creeping eragrostis.
E. reptans Nees.

† **E. Eragrostis** (Linnæus). Low eragrostis.
E. minor Host.

* **E. major** Host. Scented eragrostis.

* **E. pilosa** (Linnæus). Tufted eragrostis.

† **E. Purshii** Schrader. Pursh's eragrostis.

* **E. capillaris** (Linnæus). Capillary eragrostis.

UNIOLA Linnæus.

* **U. latifolia** Michaux. Broad spike-grass.
"Allegheny," 1888, C. B. Beadle.

DACTYLIS Linnæus.

* **D. glomerata** Linnæus. Orchard-grass.

POA Linnæus.

* **P. annua** Linnæus. Annual meadow-grass.

* **P. compressa** Linnæus. Wire-grass.

† **P. flava** Linnæus. False red-top.
P. serotina Ehrhart.

* **P. pratensis** Linnæus. Kentucky blue-grass.

* **P. trivialis** Linnæus. Roughish meadow-grass.

* **P. sylvestris** Gray. Sylvan spear-grass.

* **P. brevifolia** Muhlenberg. Short-leaved spear-grass.

PANICULARIA Fabricius.
GLYCERIA R. Brown.

* **P. nervata** (Willdenow). Nerved manna-grass.

† **P. Americana** (Torrey). Tall manna-grass.
G. grandis Watson.

FESTUCA Linnæus.

† **F. ovina** Linnæus. Sheep's fescue-grass.

* **F. nutans** Willdenow. Nodding fescue-grass.

† **F. elatior** Linnæus. Tall fescue-grass.

BROMUS Linnæus.

* **B. secalinus** Linnæus. Upright chess, cheat.

† **B. racemosus** Linnæus. Wood chess.

† **B. ciliatus** Linnæus. Rye chess.

LOLIUM Linnæus.

† **L. perenne** Linnæus. Rye-grass.

AGROPYRON J. Gærtner.

* **A. repens** (Linnæus). Couch-grass.

TRITICUM Linnæus.

* **T. vulgare** Linnæus. Wheat.
Frequently spontaneous along railroad tracks.

SECALE Linnæus.

* **S. cereale** Linnæus. Rye.
Spontaneous in waste places, occasionally.

HORDEUM Linnæus.

* **H. vulgare** Linnæus. Common barley.
Along railroad tracks.

ELYMUS Linnæus.

* **E. Virginicus** Linnæus. Virginia wild rye.

* **E. Canadensis** Linnæus. Nodding wild rye.

HYSTRIX Mœnch.

ASPRELLA Willdenow.

* **H. Hystrix** (Linnæus). Bottle-brush grass.

EQUISETACEÆ Michaux.

HORSETAIL FAMILY. I–8.

EQUISETUM Linnæus.

* **E. arvense** Linnæus. Field horsetail.

* **E. sylvaticum** Linnæus. Wood horsetail.

* **E. hyemale** Linnæus. Common scouring-rush.

* **E. lævigatum** Braun. Smooth scouring-rush.
Fawn Township, on banks of Bull Creek, July, 1885.

POLYPODIACEÆ R. Brown.

FERN FAMILY. I–5.

POLYPODIUM Linnæus.

* **P. vulgare** Linnæus. Common polypody.

ADIANTUM Linnæus.

* **A. pedatum** Linnæus. Maiden-hair fern.

PTERIS Linnæus.

* **P. aquilina** Linnæus. Bracken.

CHEILANTHES Swartz.

* **C. lanosa** (Michaux). Hairy lip-fern.
C. vestita Swartz.

PELLÆA Link.

§ **P. atropurpurea** (Linnæus). Purple-stemmed cliff-brake.

ATHYRIUM Roth.

ASPLENIUM Linnæus.

§ **A. pinnatifidum** (Nuttall). Pinnatifid spleenwort.

* **A. Trichomanes** (Linnæus). Maiden-hair spleenwort.

* **A. platyneuron** (Linnæus). Ebony spleenwort.
A. ebeneum Aiton.

§ **A. montanum** (Willdenow). Mountain spleenwort.

* **A. angustifolium** (Michaux). Narrow-leaved spleenwort.

* **A. acrostichoides** (Swartz). Silvery spleenwort.
A. thelypteroides Michaux.

* **A. Filix-fœmina** (Linnæus). Lady-fern.

CAMPTOSORUS Link.

* **C. rhizophyllus** (Linnæus). Walking-fern.

PHEGOPTERIS Fée.

* **P. hexagonoptera** (Michaux). Broad beech-fern.

* **P. Dryopteris** (Linnæus). Oak-fern.
Robinson Township, branch of Montour's Run, June 1, 1886.

DRYOPTERIS Adanson.

ASPIDIUM Swartz.

* **D. Thelypteris** (Linnæus). Marsh shield-fern.

* **D. Noveboracensis** (Linnæus). New York fern.

* **D. spinulosa intermedia** (Muhlenberg). Wood fern.

* **D. cristata** (Linnæus). Crested shield-fern.
O'Hara Township, swamp, near Poor Farm, September 20, 1899.

* **D. Goldieana** (Hooker). Goldie's fern.

? **D. Filix-mas** (Linnæus). Male fern.

* **D. marginalis** (Linnæus). Evergreen wood-fern.

* **D. acrostichoides** (Michaux). Christmas fern.

FILIX Adanson.
CYSTOPTERIS Bernhardi.

* **F. bulbifera** (Linnæus). Bladder fern.

* **F. fragilis** (Linnæus). Brittle fern.

ONOCLEA Linnæus.

* **O. sensibilis** Linnæus. Sensitive fern.

§ **O. Struthiopteris** (Linnæus). Ostrich fern.

WOODSIA R. Brown.

* **W. obtusa** Sprengel. Blunt-lobed woodsia.

DANNSTÆDTIA Bernhardi.
DICKSONIA L'Heritier.

* **D. punctilobula** (Michaux). Hay-scented fern.

OSMUNDACEÆ R. Brown.
ROYAL FERN FAMILY. I–2.
OSMUNDA Linnæus.

* **O. regalis** (Linnæus). Royal fern.

O'Hara Township, swamp near Poor Farm, May, 1900, D. A. Atkinson.

O'Hara Township, Squaw Run, June, 1900. W. N. Miller.

* **O. cinnamomea** Linnæus. Cinnamon fern.

* **O. Claytoniana** Linnæus. Interrupted fern.

OPHIOGLOSSACEÆ Presl.

ADDER'S-TONGUE FAMILY. I–1.

OPHIOGLOSSUM Linnæus.

† **O. vulgatum** Linnæus. Adder's tongue.

BOTRYCHIUM Swartz.

† **B. Lunaria** (Linnæus). Moonwort.

* **B. obliquum** Muhlenberg. Oblique grape fern.

* **B. dissectum** Sprengel. Cut-leaf grape fern.

* **B. Virginianum** (Linnæus). Virginia grape fern.

LYCOPODIACEÆ Michaux.

CLUBMOSS FAMILY. I–9.

LYCOPODIUM Linnæus.

* **L. lucidulum** Michaux. Shining club-moss.

* **L. complanatum** Linnæus. Trailing club-moss.

Moon Township, Tomlinson's Hollow, near Carnot, April 18, 1898; Miss Lily Dally.

O'Hara Township, Squaw Run, October, 1899; J. L. Graf.

SELAGINELLACEÆ Underwood.

SELAGINELLA FAMILY. I–10.

SELAGINELLA Beauvois.

* **S. apus** (Linnæus). Creeping selaginella.

Fawn Township, Branch of Bull Creek, July, 1895.

Harrison Township, Little Bull Creek, near Burtner's stone house, August 25, 1900; John Thorpe.

III. SOME NEW AND LITTLE KNOWN FOSSIL VERTEBRATES.

By J. B. Hatcher.

(Plates I–IV.)

The present paper is based upon material brought together by the paleontological expedition of 1900, for which Mr. Andrew Carnegie generously supplied the necessary funds. The material has been freed from the matrix and prepared for study, either directly by, or under the immediate supervision of, Mr. A. S. Coggeshall, the chief preparator of the Museum in the Section of Vertebrate Paleontology. In the performance of this work Mr. Coggeshall has shown unusual skill and patience. The illustrations are from drawings by Mr. W. J. Carpenter and photographs by Mr. A. S. Coggeshall. In each instance they accurately illustrate important details of form and structure in the specimens described.

Class **PISCES.**

Platacodon nanus[1] Marsh.

In a former paper I have called attention to the undoubted ichthyic nature of the diminutive teeth collected by the writer several years ago and described by the late Professor Marsh as mammalian under the above name.[2] Subsequent to Professor Marsh's description of the types of this genus and species the present writer discovered in the same immediate locality, from which he secured the type specimens, two small dental plates, each bearing ankylosed teeth of the same size and pattern as the detached teeth described by Professor Marsh. The nature of these dental plates and the teeth they supported fixed at the same time their ichthyic nature and their identity with Platacodon. Both of these points Professor Marsh fully realized and frequently expressed in conversation with the writer. Other pressing duties doubtless prevented his making the necessary correction prior to his untimely death. During the past season I had occasion to visit the same

[1] See Am. Journ. Sci., Vol. XXXVIII, Aug., 1899, p. 178.

[2] See Science, N. S., Vol. XII, Nov. 9, 1900, p. 719.

locality that afforded Marsh's types, and was fortunate in finding a third fragment (No. 104)[3] of a dental plate with two teeth in position and exhibiting the scars of several other detached teeth as shown in Plate I, Figs. 5 and 6. These teeth have chisel-shaped crowns and are very much compressed, apparently with the longer axis directed transversely. They are quite distinct from other dental plates found somewhat abundantly in the same deposits, which are also of ichthyic nature, but in which the crown of each tooth consists of a single rather low tubercle, circular in cross-section.

Class **REPTILIA.**

Subclass **Dinosauria.**

Order PREDENTATA.

Suborder ORNITHOPODA.

The Dermal Covering of Claosaurus[4] Marsh.

The first information regarding the nature of the dermal covering of dinosaurs was given by the writer in a brief communication to Science on *The Carnegie Museum Paleontological Expedition of 1900.*[5] A little later Mr. F. A. Lucas[6] called attention to the appearance of dermal impressions similar to those mentioned by the writer, and shown by material collected by Mr. Robert Butler for the U. S. National Museum, and pertaining to the same genus, *Claosaurus* (Thespesius), as does that on which the present observations are based. Through the kindness of Mr. Lucas I am able to give here (Fig. 1) an illustration, natural size, of these impressions as represented on a slab of sandstone enclosing the bones of one of the fore limbs of the specimen in the U. S. National Museum.

[3] The numbers enclosed in brackets in this paper refer to the Card Catalogue of Fossil Vertebrates in the collection of the Carnegie Museum.

[4] *Claosaurus* Marsh has been considered to be a synonym of *Thespesius* Leidy, (See Lucas, in Science, N. S., Vol. XII, Nov. 23, 1900. p. 809); while the latter genus has been considered a synonym of *Hadrosaurus* Leidy, by another authority. (See *Dinosaurierreste aus Siebenbürgen*, by Franz Baron Nopsca, jun., Band LXVIII der Denkschriften der Mathematisch-Naturwissenschaftlichen Classe der Kaiserlichen Akademie der Wissenschaften, pp. 555–591.) In consideration of the incomplete nature of Leidy's type of *Thespesius* I retain *Claosaurus.*

[5] See Science, N. S., Vol. XII, Nov. 9, 1900, pp. 719–720.

[6] See Science, N. S., Vol. XII, p. 809.

Among other remains of Laramie dinosaurs, collected in Wyoming during the past season, there is a large slab of sandstone, containing a considerable portion of the pelvis and sacrum and some twenty of the anterior caudals, as well as numerous ossified dorsal tendons, so abun-

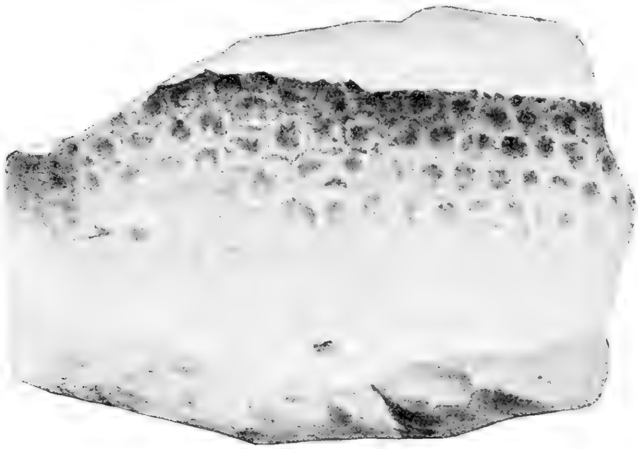


FIG. 1.

Dermal impression from forelimb of Claosaurus (Thespesius) annectens Marsh. (Nat. size). (Specimen in U. S. National Museum.)

dant in *Claosaurus*. This specimen (No. 106) derives its chief interest, however, from the fact that there are preserved in the region extending from the fifteenth to the twentieth caudals an impression of the dermis, which shows these animals to have been covered in life with small bony, or chitinous scutes. In my original notice of these dermal scutes I referred to them as small hexagonal plates. A closer examination, however, shows that they are not all of the same size or geometrical form. Our material shows that there was in some instances a central heptagonal plate some 9 mm. in greatest diameter,[7] surrounded by seven somewhat smaller hexagonal plates. These, or similar rosettes, appear to have been arranged in bands extending from the top of the dorsal region of the tail down the sides in parallel lines, each band separated from the succeeding and preceding series by narrow transverse ridges, the interstices between the hexagonal plates and transverse

[7] In my notice in Science I spoke of thes plates as somewhat more than half an inch in diameter, while by actual measurement they are somewhat less than half an inch.

ridges being filled in with smaller plates. The exact outline of some of these smaller plates cannot be determined from our specimen. A figure of a portion of the dermal impression is shown in Plate I, Fig. 8. The material was found by the writer in the Ceratops beds of the Upper Laramie, about three miles north of the mouth of Doegie Creek, in Converse County, Wyoming.

Class **MAMMALIA.**

Order UNGULATA.

Suborder ARTIODACTYLA.

Leptochœrus quadricuspis, sp. nov.

The type of the present species (No. 100) consists of the right maxillary with P.$\frac{3}{}$ and $\frac{4}{}$ and M.$\frac{1}{}$, $\frac{2}{}$, and $\frac{3}{}$ in position and in an excellent state of preservation. It was found by the writer in a small exposure in the lower Oreodon beds about half a mile west of south of the Brewster and Emmons Ranch, on Warbonnet Creek, in Sioux Co., Nebraska. Associated with the type specimen, but evidently belonging to different individuals, were found other remains of *Leptochœrus*, consisting of an isolated tooth, M.$\frac{2}{}$ (No. 101), a fragment of a left ramus (No. 102) with M. , $\frac{}{2}$, $\frac{}{3}$, a portion of a right ramus (No. 103) with M.$\frac{}{1}$, $\frac{}{2}$, $\frac{}{3}$ and P.$\frac{}{4}$ and the alveoles of P.$\frac{}{3}$. The last mentioned specimen (No. 103) may be taken as the collateral type of the species.

The present species chiefly differs from *L. spectabilis* Leidy,[8] the type of the genus, in size, it being a third smaller than the latter, as will be seen by a comparison of the measurements given here with those of Leidy published in his original description. A comparison of the specimens shows other structural differences as well. From *L. gracilis* of Marsh[9] it is distinguished by a greater complexity of tooth structure, and, more especially, by the structure of P.$\frac{3}{}$ and M.$\frac{1}{}$ and $\frac{2}{}$.

In the type of the new species P.$\frac{3}{}$ is the more prominent tooth of the series. Its crown is triangular in outline and bears four distinct cusps, which have suggested the specific name. Of these cusps three are external and one internal. Of the three external cusps, the one in the middle is much the larger, and it is situated directly opposite the internal cone, which latter is of about the same prominence as the an-

[8] See Proc. Acad. Nat. Sci. Phila., p. 88, 1856.

[9] See Am. Jour. Sci., Vol. XLVIII, Sept., 1894, pp. 271–273.

terior and posterior external cones, and stands at the apex of a triangle, the base of which would be formed by a line connecting the two latter cones. A rather strong basal cingulum extends all along the external and anterointernal borders of this tooth, completely surrounding externally the anteroexternal cone. There is no basal cingulum on the posterointernal border of this tooth.

Premolar$^{\underline{4}}$ is a much smaller and simpler tooth than P.$^{\underline{3}}$ or M.$^{\underline{1}}$ which immediately precede and succeed it. The crown of P.$^{\underline{4}}$ supports but two cones, the one external, the other internal. The former is a little the more prominent of the two. This tooth is quadrangular in outline and bears a basal cingulum on its exterior, anterior, and posterior borders, but not on its interior border.

Commencing with M.$^{\underline{1}}$ the molars gradually decrease in size and become less complicated from M.$^{\underline{1}}$ to M.$^{\underline{3}}$. The crown of M.$^{\underline{1}}$ is subquadrangular in outline, and bears three principal cones, two of which are external and of about equal size, while the third is internal and somewhat larger. This internal cone shows a decided tendency to divide into anterior and posterior internal cones, the latter of which is much the smaller of the two and partakes more of the nature of a conule. Two ridges diverge from near the apex of the internal cone of this tooth and form small anterior and posterior intermediate cones, or conules, so that there are on M.$^{\underline{1}}$ six cusps, two of which are external, two internal, and two intermediate. The two intermediate and the posterointernal are much less prominent than the other three. A basal cingulum surrounds the external and anterior and posterior borders of this tooth.

The succeeding tooth, M.$^{\underline{2}}$, has a quadrangular crown, supporting two external cones and a somewhat larger internal cone, which shows less tendency to division than does the same cone on M.$^{\underline{1}}$, but does, nevertheless, show a small conule developing near the apex on its posterior side. The two intermediate cones mentioned as present on the crown of M.$^{\underline{1}}$ are also present on M.$^{\underline{2}}$. There is a basal cingulum on the external and posterior and anterior borders of this tooth.

Molar$^{\underline{3}}$ is much the smaller tooth of the molar series, and is of somewhat simpler structure than the others. There are two small external cones and a rather prominent, perfectly simple, inner cusp, with but faint indications of the intermediate conules noticed in M.$^{\underline{2}}$ and M.$^{\underline{3}}$. A basal cingulum surrounds the tooth except on the internal side, where it is quite smooth.

The presence of a fourth cone on P.^{3}, together with the tendency to division exhibited by the internal cones of M.^{1} and M.^{2}, at once distinguish this species from *L. gracilis* of Marsh. By some these characters might be considered of generic importance, but I have preferred to treat them as of only specific value.

A diastema exists in front of P.^{3}, but the bone is broken away a little in front of that tooth. The infraorbital foramen is situated above and slightly in advance of the anterior border of P.^{3}. A crown view of the type specimen is shown in Plate I, Fig. 3, while Fig. 4 is a reproduction of Marsh's type of *L. gracilis.*

I have selected No. 103 as a collateral type of the present species, since it agrees in size and was found in the same locality with the type. It consists of a portion of a right ramus with P.$_{\overline{4}}$ and M.$_{\overline{1}}$, $_{\overline{2}}$, $_{\overline{3}}$ in position and the alveoles of P.$_{\overline{3}}$. It is about one third smaller than Leidy's type of *L. spectabilis*, while agreeing very well in size and tooth structure with the lower jaw of Marsh's type of *L. gracilis*, though differing from the latter in wanting the deep groove on the inner side of the jaw, which, according to Marsh, extends from the dental foramen nearly to the symphysis. In the present specimen P.$_{\overline{4}}$ is the larger tooth of the series. It is subtrenchant and supports a principal median cone with a small tubercle on the narrow anterior border, while expanding posteriorly to form a broad heel with low external and internal cones. Molars $_{\overline{1}}$ and $_{\overline{2}}$ are quadrangular in outline, with crowns supporting four cusps, two anterior and two posterior, each pair connected by transverse ridges, while in addition an oblique ridge joins the anterointernal cone with the posteroexternal cone of each true molar, a character not shown in Marsh's figures of *L. gracilis.* In addition to the four cones and three crests already described, there is in M.$_{\overline{3}}$ a third posterior lobe bearing a fifth cone situated behind and intermediate to the posterior paired cones.

The ramus is proportionately quite strong and increases in depth anteroposteriorly. There is a small foramen on its external surface between P.$_{\overline{3}}$ and $_{\overline{4}}$, about midway between the superior and inferior borders.

MEASUREMENTS OF THE TYPE (No. 100).

	M.
Length of superior true molar series	.013
" " M.^{1}	.005
" " M.^{2}	.004
" " M.^{3}	.0035
" " P.^{4}	.0042
" " P.^{3}	.007

	M.
Breadth of $P.^{3}$	.005
Greatest breadth of $P.^{4}$	.0065
" " " $M.^{1}$	.0063
" " " $M.^{2}$	.0055
" " " $M.^{3}$	.0045

MEASUREMENTS OF COLLATERAL TYPE (NO. 103).

Depth of ramus below anterior border of $P._{4}$	.0105
" " " " middle of $M._{2}$	.013
Length of inferior true molar series	.0158
" " $M._{1}$	.005
" " $M._{2}$	.005
" " $M._{3}$	.0058
" " $P._{4}$	.007
Greatest breadth of $P._{4}$	.005
" " " $M._{1}$	.005
" " " $M._{2}$	.005
" " " $M._{3}$	.004

TAXONOMY OF LEPTOCHŒRUS.

There has been a disposition on the part of some authorities to place Leptochœrus among the Primates. This has doubtless been due to the very close resemblance shown by the true molars of this genus to the same teeth in certain genera of the earlier Primates, more especially of the Prosimiæ or Lemurs. Most if not all of the discoveries of Primates, that have from time to time been reported from the White River, Oligocene formations of the West, have been based on the true molars of Leptochœrus. Such references of these teeth when found unassociated with the premolars were very natural and quite in accordance with our knowledge of comparative odontography. The premolars are however quite unlike those of any known primate living or extinct, while at the same time showing very close resemblances, as do also the molars, to certain artiodactyls with the bunodont type of tooth. These facts, together with certain skeletal characters referred to by Marsh in his description of *L. gracilis*, would appear to establish the artiodactyl affinities of the genus.

Suborder PERISSODACTYLA.

Orohippus ? sp.

In our collections of vertebrates from the White River Beds there is an isolated superior molar (No. 99), which agrees in general

structure with the superior molars of *Orohippus*, and I have provisionally referred it to that genus. I refrain from proposing for it a new generic name, while at the same time recognizing the improbability that the genus Orohippus should have existed continuously from the Bridger Eocene to the White River Oligocene. The unexpected occurrence of a tooth of this pattern, indicative of an animal closely allied to the middle Eocene equines, would appear to justify a notice of its discovery, with a brief description of its principal characters, though its exact generic and specific distinction will be deferred until the discovery of additional material shall make known its true affinities.

This tooth, which appears to be the left first superior molar, was found by Mr. W. H. Utterback at the base of the Titanotherium Beds, in an exposure about one mile south of Henry's Dam, on Squaw Creek, in Sioux County, Nebraska. A crown view of it is shown on Plate I, Fig. 7. It agrees almost exactly in size and structure with the first molar of *Orohippus* as figured by Wortman on page 108, Vol. VIII of the Bulletins of the American Museum of Natural History. The crown is in outline almost a perfect square, and supports four subequal cones, each occupying one of the four angles of the tooth. In addition to these four principal cones there are two small intermediate cones, or conules. A basal cingulum surrounds the tooth except on the inner side. This tooth has an anteroposterior diameter of .009 metres and a maximum transverse diameter of .0095 metres.

Trigonias osborni Lucas.[10]

Dentition, I.$\frac{3}{3}$, C.$\frac{1}{0}$, P.$\frac{4}{4}$, M.$\frac{3}{3}$ = 42. *None of the upper premolars are strictly molariform. Skull much elongated and very large in comparison with the size of the skeleton. Manus tetradactyl.*

This new genus of the early Oligocene Rhinoceridæ is represented in our collections by two skulls and one nearly complete skeleton, beside numerous other bones, all from the lower Titanotherium Beds of the White River Oligocene. Only a very small portion of this material has as yet been unpacked and freed from the matrix. It is the intention of the present communication to record only a few of the more important characters, reserving a description of the complete osteology for a future paper, after all of our material has been prepared for study.

[10] See Proc. Nat. Museum, Vol. XXIII, No. 1207, pp. 221–223.

THE CRANIUM.

In our collection there is one nearly complete skull, without the lower jaw (No. 96) of a very old individual, in which the structure of the molar and premolar teeth, except in M.$\frac{3}{}$, has been obliterated by wear. A second skull (No. 98), also wanting the lower jaw, but probably pertaining to a younger, though fully adult animal, shows the molars and premolars on either side in splendid condition, save P.$\frac{1}{}$, which has been lost. A third specimen, (No. 97), consists of a complete lower jaw with all the teeth in position on either side, with the exception of I.$\frac{}{3}$, which is represented only by an alveolus. No. 96 is the cranium of a very old individual, apparently a female. When found in the matrix it lay on one side, and had been subjected to great pressure, resulting in considerable distortion, the entire cranium being compressed laterally. It is proportionately long and narrow, exhibiting few rugosities. There is a distinct, rather sharp, and somewhat elevated sagittal crest, expanding posteriorly into the slightly elevated, narrow, emarginate occipital crest, which overhangs the occipital condyles. The paroccipital process is short and blunt, curves forward inferiorly, but does not come in contact with the longer, but rather slender, postglenoid process, so that the meatus auditorius externus is left open below. The zygomata are of considerable vertical diameter, but are exceptionally thin in transverse diameter. The squamosals enter into the construction of the zygomata to a greater extent than do the malars. The orbit is nearly circular in outline with a decided postorbital constriction due to the presence of pronounced postorbital processes both on the frontals and malars. The brain-case is small. There is a marked temporal constriction. The infraorbital foramen is placed directly above the middle of P.$\frac{4}{}$. The nasal incision is very deep; its posterior margin is on a line drawn vertically from the posterior border of P.$\frac{2}{}$. The premaxillaries are long and slender and have an extensive contact with the maxillaries. The maxillopremaxillary suture extends from in front of the canine to a point directly above the middle of P.$\frac{1}{}$. The premaxillaries do not come in contact with the nasals and do not coössify at their anterior extremities. The nasals are long, slender and acute. They terminate anteriorly almost directly above the anterior border of the premaxillaries. A side view of the skull, one fourth natural size, is shown in Plate II, Fig. 1.

THE MANDIBLE.

The present description of the mandible of *Trigonias osborni* is based on a complete lower jaw (No. 97) of a somewhat young animal, in which $\mathrm{M.}_{\overline{3}}$ is seen in process of eruption. The jaw is proportionately long and remarkably slender. It does not appreciably increase in depth from the posterior border of the symphysis to the posterior border of $\mathrm{M.}_{\overline{2}}$. The inferior border is gently convex. There is a mental foramen directly below the anterior root of $\mathrm{P.}_{\overline{2}}$. The angle is not produced below the inferior border of the jaw. The angle is slightly deflected and there is a short, gently concave area between its anterior extremity and the preceding inferior border of the jaw. The condyle is placed almost at right angles to the ascending ramus, with the articular surface somewhat more elevated and broader externally than internally. The coronoid process is well developed and pointed posteriorly at the apex. The masseteric fossa is deep and situated rather high up on the ascending ramus; its inferior border is on a line approximating that of the crowns of the inferior teeth. The inferior dental foramen is placed somewhat nearer the inferior than the superior border and just behind the last molar. The symphysis is long, narrow, and obliquely horizontal. It terminates posteriorly immediately below the mental foramen, and there is a decided constriction anterior to $\mathrm{P.}_{\overline{1}}$.

THE DENTITION.

The dental formula is $\mathrm{I.}\frac{3}{3}$, $\mathrm{C.}\frac{1}{0}$, $\mathrm{P.}\frac{4}{4}$, $\mathrm{M.}\frac{3}{3} = 42$.

The superior dentition: $\mathrm{I.}^{\underline{1}}$ is hypertrophied, and is a large, laterally flattened tooth, with a chisel-shaped, rectangular crown. It is much the more persistent of the superior incisor series. Incisors $^{\underline{2}}$ and $^{\underline{3}}$ are lost in both of our skulls, but the alveoli are preserved on either side in No. 96, and the same is true of the superior canine, which is separated from $\mathrm{I.}^{\underline{3}}$ by a short diastema. Between the canine and $\mathrm{P.}^{\underline{1}}$ there is a long diastema. $\mathrm{P.}^{\underline{1}}$ is unfortunately represented in both our crania only by the roots. These indicate that this tooth was rather large and well fixed in the jaw for a superior first premolar. The succeeding teeth are all present in both our skulls, but too much worn in No. 96 to permit of a description of their structure, except in $\mathrm{M.}^{\underline{3}}$, which is fairly well preserved. In No. 98 these teeth are well preserved and show the following characters: The premolar series increase in size anteroposteriorly. None of the superior premolars are molari-

form. *P.^{2} has not yet developed the two distinct transverse crests so characteristic of all previously known Aceratheres and Rhinoceroses.* All the premolars show a rather large postfossette and a small prefossette opening into a larger medifossette entirely enclosed internally. There is a small crista on each, separating the prefossette from the medifossette, while the ectoloph of each supports an anterior and posterior costa and a rudimentary parastyle. Internal cingula are present on P.^{2}, ^{3}, ^{4}. I wish here to call attention to the apparent difference in the structure of P.^{4} on opposite sides, due to different degrees of wear exhibited by these teeth in the same skull as shown in Plate II., Fig. 2. In M.^{1} the median sinus is well developed, completely separating the protocone and hypocone. The ectoloph supports a well developed parastyle, separated from the anterior costa by a well marked fold. The posterior costa is faint. This tooth is much worn, but remnants of the post- and medifossettes remain. M.^{2} is the larger tooth of the series; the protocone is more prominent than the hypocone; there is a postfossette and a medifossette invaded by an antecrochet. The ectoloph supports a well developed parastyle and anterior costa, with scarcely an indication of the posterior costa. In M.^{3} the metacone is absent, while the protocone, paracone and hypocone, are well developed. There is a deep medifossette unobstructed by either crochet, antecrochet, or crista. There is a parastyle and a strong anterior costa. All the superior molars bear anterior and posterior basal cingula.

The inferior dentition: The first pair of lower incisors are small spatulate teeth with the longer axis directed transversely. They are remarkably procumbent and are placed anterior to and between the second pair of incisors, which have become hypertrophied into large procumbent teeth, which in the rhinoceroses generally, have been usually mistaken for canines rather than incisors. Just below their crowns these teeth are oval in cross-section. Immediately behind I.$_{2}$ there is a shallow alveolus, which with Lucas, I have assigned to I.$_{3}$ rather than the canine. Whether it was occupied by the canine or I.$_{3}$ is of minor importance,—in either case it fixes the large procumbent tooth as a modified incisor, as was pointed out by Lucas in his original description of the genus. I.$_{3}$ is separated from P.$_{1}$ by a long diastema. P.$_{1}$ is a small, laterally compressed tooth, fixed in the jaw by two roots, and bearing on its crown anterior, median, and posterior cones arranged longitudinally, with but faint indications of

the anterior, median, and posterior cross-crests. Premolars $_{\overline{2}}$, $_{\overline{3}}$, $_{\overline{4}}$, are all submolariform, regularly increasing in their approximation to the true molar pattern from P.$_{\overline{2}}$ to P.$_{\overline{4}}$. In each of these teeth the anterior and posterior cross-crests are not as fully developed as are the same elements in the lower true molar series. The inferior molars exhibit no distinctive characters.

MEASUREMENTS.

FULLY ADULT SKULL, (NO. 96).

Length in straight line from point of nasals to emargination of occipital crest	496 mm.
Height of occiput above lower border of occipital condyles	155 mm.
Depth of incision of anterior nares	140 mm.
Greatest length of premaxillaries	110 mm.

LOWER JAW OF YOUNG ANIMAL, M.$_{\overline{3}}$, NOT FULLY ERUPTED.

Greatest length of jaw on straight line	385 mm.
Length of symphysis	85 mm.
Depth of ramus below P.$_{\overline{2}}$	51 mm.
Depth of ramus below M.$_{\overline{2}}$	51 mm.
Height of coronoid process above inferior angle	187 mm.

SUPERIOR DENTITION OF FULLY ADULT SKULL.

Distance from anterior border of I.$^{\underline{1}}$ to posterior border of canine	63 mm.
Length of diastema between canine and P.$^{\underline{1}}$	37 mm.
Length of premolar series	86 mm.
Length of molar series	103 mm.

INFERIOR DENTITION OF YOUNG LOWER JAW.

Transverse diameter of crown of I.$_{\overline{1}}$	8.5 mm.
Fore and aft diameter of crown of I.$_{\overline{1}}$	6 mm.
Length of crown of I.$_{\overline{2}}$	36 mm.
Transverse diameter of I.$_{\overline{2}}$ at base	16.5 mm.
Supero-inferior diameter at base	13.5 mm.
Length of diastema between I.$_{\overline{3}}$ and P.$_{\overline{1}}$	29 mm.
Length of premolar series	95 mm.
Length of molar series	117 mm.

THE SCAPULA, FORE LIMB, AND MANUS.

The scapula is comparatively long, slender, and subtriangular in outline. The posterior border is concave, and extends from the glenoid cavity for about two thirds of the total length of the scapula, where,

at an obtuse angle, it meets the convex superior border. The anterior border is convex. The postscapula is triangular in outline, while the general outline of the prescapula is subcrescentic. The coracoid is small. The spine extends from about two inches above the glenoid cavity to the superior border. It is triangular in outline with a rather strong spinous process directly opposite the angle formed by the junction of the posterior and superior borders. The glenoid cavity is rather deep and subcircular in outline.

The humerus, like all the other bones of the fore leg, is proportionately rather long and slender. The greater and lesser tuberosities are prominent, and the bicipital groove is correspondingly deep. The deltoid ridge is well developed and continuous throughout one half the entire length of the bone. The supinator ridge is low and short. The external condyle is prominent, while the internal is faint, or obsolete. The ulnar and radial articulations enter subequally into the construction of the trochlea, the former slightly predominating. The anconeal fossa is deep.

The radius is rather broad and flat, with its transverse diameter almost twice the fore and aft diameter. The distal end is much broader and deeper than the proximal. The anterior surface is strongly convex inferiorly, while the posterior surface is concave.

The shaft of the ulna is triangular in cross-section. The olecranon is of moderate height, broad, and with an anterosuperior notch. The coronoid process is large and sharp anteriorly, in harmony with the deep anconeal fossa of the humerus. Distally there is a moderate articular facet for the pyramidal, and relatively a rather large articular surface for the pisiform.

The manus of *Trigonias osborni* differs from all other American Aceratheres, so far as we know their structure, in being functionally tetradactyl. In the present genus and species the fifth digit is not only present, but it still retains all the elements (metacarpal, first, second, and third phalanges and sesamoids) common to digits II, III, and IV. These elements are however somewhat reduced in size.

The carpus is composed of those elements that are ordinarily found in that of the perissodactyl manus, viz., superiorly, the scaphoid, lunar, pyramidal, and pisiform; inferiorly, the trapezium, trapezoid, magnum and unciform. The scaphoid is much the larger bone of the proximal series. It articulates above with the radius by a concave surface of irregular pentagonal outline. Inferiorly the scaphoid artic-

ulates with the trapezium, trapezoid and magnum, covering the entire upper surface of the first two, and only about one half the superior anterior surface of the magnum, thus contrasting strongly with some of the later tridactyl Aceratheres, in which the scaphoid covers the entire superior anterior surface of the magnum. The facet for the trapezium is slightly concave, and has the general form of an elongated ellipse. The articular facet for the trapezoid is concave transversely and convex anteroposteriorly. Two rather sharp ridges separate it from the facet for the trapezium on the one side and that for the magnum on the other. The latter facet is triangular in outline, and gently concave transversely. The radial facet of the lunar is strongly convex anteroposteriorly, while inferiorly this bone articulates with the magnum by an elongated, deeply concave facet, broad posteriorly, but somewhat constricted anteriorly. With the unciform it has also an extensive contact, ovate in outline and concave anteroposteriorly. The pyramidal shows the usual superior facets for the ulna and pisiform, while inferiorly it articulates only with the external superior surface of the unciform, occupying somewhat less than one half the upper surface of that bone. The pisiform articulates about equally with the pyramidal and ulna. The neck is much constricted, while the tuberosity is greatly expanded, terminating superiorly in an elevated process. The trapezium is the most diminutive bone in the distal series of carpals. It articulates superiorly with the scaphoid and exteriorly with the trapezoid, terminating inferiorly in a small pointed process without articular surface. The trapezoid is a small bone with superior and inferior facets, concave anteroposteriorly and convex laterally. These articulate respectively with the scaphoid and metacarpal II. The magnum is comparatively large, and bears three articular facets on its superior surface, one situated anteriorly and external, articulating with the scaphoid; a second, narrow in front, but expanding posteriorly, situated about midway between the external and internal margins, and articulating with the lunar; the third is placed anteriorly and internal, and articulates with the unciform. Inferiorly the magnum articulates only with metacarpal III, while there is also a lateral articulation between the magnum and metacarpal II. The tuberosity is narrow and directed downward and inward. The unciform is much expanded inferiorly and articulates by a continuous facet with metacarpals V, IV, and the external one third of the proximal end of metacarpal III, and in addition it covers about one third

of the upper anterior surface of the magnum. This extensive, continuous articular surface is exceptionally regular in outline, and its anterior edge describes an almost perfect semicircle. Superiorly the unciform articulates subequally with the lunar and pyramidal.

The metacarpus. Although tetradactyl in structure, the manus of Trigonias shows a decided tendency in the direction of tridactylism. Metacarpal III is the longer and much the stronger bone of the series, while metacarpals II and IV are subequal. The inevitable suppression to which the fifth digit is destined, is already distinctly indicated both by the inferiority of its metacarpal and by that of the succeeding phalanges. Nevertheless, there is still a very considerable modification necessary before the manus of Trigonias assumes the typically tridactyl structure of the later Rhinoceroses and Aceratheres. Metacarpal III is decidedly asymmetrical, and the axis of the foot is external to its median line, while the superior anterior surface of the magnum is not so completely occupied by the scaphoid as in the later tridactyl forms.

The phalanges. As in all the Rhinocerotidæ, the phalanges are short and rather flat, with rugose upper surfaces. The unguals, especially those of digits II, III, and IV, are broad and very short. There are present the metacarpophalangeal and navicular sesamoids characteristic of Perissodactyls in general.

The material, upon which the above description of the scapula, fore limb, and manus is based, consists of a complete right manus, limb, and scapula (No. 95) found in position along side of the skulls (Nos. 96 and 98) described above. It appears to pertain to the same individual as No. 96, and associated with it was the opposite fore-limb, pelvis, ribs, vertebræ, hind limbs, and most if not quite all of the skeleton, for the most part disarticulated. All this material, including the lower jaw described above, was taken from a single bone deposit, near the base of the Titanotherium Beds, not exceeding in area a space twenty feet in length by ten in width, and all from the same horizon. The locality is about three miles north of the old Brewster and Emmons Ranch, on Warbonnet creek, Sioux County, Nebraska. Front and side views of the manus are shown on Plate III, Figs. 1 and 2, and an external side view of the manus, scapula, and limb in position on Plate IV.

MEASUREMENTS.

Length of scapula	327 mm.
Greatest breadth of scapula	160 mm.

Length of humerus from proximal to distal articular surfaces	290 mm.
Greatest breadth of distal end of humerus	87 mm.
Greatest length of radius	284 mm.
Greatest breadth of distal end of radius	73 mm.
Greatest breadth of proximal end of radius	63 mm.
Length of ulna	345 mm.
Distance from anterior border of coronoid process to top of olecranon	101 mm.
Depth of ulna opposite coronoid process	91 mm.
Length of metacarpal II	111 mm.
" " " III	128 mm.
" " " IV	101 mm.
" " " V	78 mm.
Combined length of phalanges of digit II	61 mm.
" " " " " " III	61 mm.
" " " " " " IV	61 mm.
" " " " " " V	39 mm.

THE TAXONOMY OF TRIGONIAS OSBORNI.

From the above description it will be seen that *Trigonias osborni* is the most primitive and least specialized member of the Rhinocerotidæ at present known. Its generalized nature is shown alike by the tetradactyl manus, the unreduced number of superior teeth, and the simple structure of the superior premolars. It falls naturally into Series I of the American Oligocene Aceratheres as defined by Osborn, and from its generalized nature, as well as geological horizon, (base of the Titanotherium Beds), it should be considered as the most primitive form known to that series. It appears to stand directly ancestral to *Leptaceratherium trigonodum* of Osborn,[11] from which it differs essentially in the unreduced superior dentition and the simpler structure of the superior premolars, more especially of P.$^{\underline{2}}$. When the foot structure of the other Aceratheres of this series is definitely known it will probably be found that the manus is tetradactyl in both *Leptaceratherium trigonodum* and *Aceratherium mite*, while that of *A. platycephalum* may perhaps be found to have reached the tridactyl stage. The following diagram is introduced to show at a glance the distinctive characters of the two series of American Oligocene Rhinoceroses proposed by Osborn and to indicate at the same time the geological horizon of the different genera and species contained in each. It is a modified combination of the tables introduced by Osborn on pages 126 and 129 of his memoir on extinct Rhinoceroses referred to above.

[11] See Mem. of the Am. Mus. of Nat. Hist., Vol. I, Part III, p. 126.

Horizon.		*Ser es I.*	*Series II.*
		I.$_{\overline{2}}$ oval in cross-section and procumbent. Manus usually tetradactyl. Ancestral to the Miocene Aceratheres and the true Rhinoceroses.	I.$_{\overline{2}}$ triangular in cross-section and obliquely fixed in jaw. Manus tridactyl so far as at present known. Ancestral to the Diceratheres.
Protoceras Beds.		Aceratherium platycephalum.	Diceratherium (Aceratherium) tridactylum.
Oreodon Beds.		Representatives of this series undoubtedly present, but as yet undiscovered.	Aceratherium occidentale. Aceratherium copei.
Titanotherium Beds.	*Upper.*	Leptaceratherium trigonodum.	Representatives of this series as yet undiscovered in Titanotherium Beds.
	Middle.	Leptaceratherium trigonodum. Aceratherium mite.	
	Lower.	Trigonias osborni.	

EXPLANATION OF PLATES.

PLATE I.

Fig. 1. Crown view of left ramus (No. 97) of *Trigonias osborni*, ¼ natural size.

Fig. 2. Side view of left ramus (No. 97) of *Trigonias osborni*, ¼ natural size.

Fig. 3. Crown view of superior teeth (No. 100) of type of *Leptochœrus quadricuspis*, twice natural size.

Fig. 4. Crown view of superior teeth of *L. gracilis*, twice natural size. After Marsh.

Figs. 5 and 6. Crown view of dental plate (No. 104) of *Platacodon nanus*, three times natural size.

Fig. 7. Crown view of superior molar (No. 99) of *Orohippus* ? sp. Natural size.

Fig. 8. View of dermal impression of *Claosaurus annectens*, preserved on block of sandstone (No. 105). Natural size.

PLATE II.

Fig. 1. Side view of skull (No. 96) of *Trigonias osborni*, ¼ natural size.

Fig. 2. Crown view of superior dentition (No. 98) of *T. osborni*, ½ natural size.

PLATE III.

Fig. 1. Oblique front view of right manus of *Trigonias osborni: s*, scaphoid; *l*, lunar; *py*, pyramidal; *td*, trapezoid; *m*, magnum; *n*, unciform. A little less than half natural size. From a photograph.

Fig. 2. Inner side of right manus of *Trigonias osborni: pi*, pisiform; *s*, scaphoid; *l*, lunar; *tm*, trapezium; *td*, trapezoid; *m*, magnum. About one half natural size. From a photograph.

PLATE IV.

Fig. 1. External side view of right scapula, limb and manus of *T osborni* in position. About $\frac{1}{7}$ natural size. (From a photograph.)

IV. THE REPTILES OF ALLEGHENY COUNTY, PENNSYLVANIA.

BY D. A. ATKINSON.

In compiling this list of local reptiles considerable difficulty has been encountered owing to the thickly settled condition of Allegheny County, and the lack of research in this branch before the population became so dense. Civilization means, among other things, the destruction of the natural fauna of a region, or at least of that portion of it, which is neither easily domesticated, nor amply provided with means for migrating before its advance. Especially is this true of reptiles, which, owing to an ignorant prejudice, are generally killed on sight without consideration of their usefulness or harmlessness. Many species now rare in this locality must have been abundant at one time, and at least two species have become extinct within the limits of our county during the past forty years.

The pollution of many of our streams, and through them some of the swamps and ponds, by drainage from coal-mines, refuse from oil- and gas-wells, and the waste products of the various kinds of manufactories, has played an important part in the decrease of the number of our reptiles, chiefly by destroying their food-supply. As the ponds and swamps are few and small, we have a scarcity of the species which inhabit such places, especially of the aquatic turtles, which, with the exception of several common species, are locally almost extinct.

The fear and dislike with which most people regard snakes is to a great extent groundless. Of the snakes, occurring in Allegheny county at the present time, only one species, *Ancistrodon contortrix* (copperhead), is at all poisonous, and its habits are such that it is seldom met with, even where it occurs in abundance. The other species are entirely harmless, and many of them are beneficial on account of their feeding on mice, rats, weasels, and insects. Some of the larger species, notably the black-snakes, are accused of eating eggs, also young chickens, and drinking milk. Undoubtedly they may do this in some cases, but it is not their regular diet. Of course "snake stories" have been told as far back as history extends, but there is no excuse at the present day for the publication of such stories

as frequently appear in our newspapers, and which must either be regarded as an insult to public intelligence, or as overworked jokes.

Some observations on the habits of certain species are recorded here, and it is hoped that this may stimulate further research in this line, as the life-history of many common species is almost unknown.

Completeness is not claimed for this catalogue. There are several species not yet taken here, which, according to geographical range, may possibly occur within our limits. Furthermore, several species are included in this list, which, while not yet taken within the limits of the county, have been captured in adjoining counties, and may be found here at any future time. When this is the case it is so stated in the reference to that species.

Class **REPTILIA.**

This class is represented in Allegheny County by three orders: Ophidia, Lacertilia, and Chelonia.

KEY TO LOCAL ORDERS OF REPTILIA.

Limbs absent; body elongated, and covered with scales; teeth present. OPHIDIA (Snakes).

Limbs four in number; body shorter, and covered with small scales; teeth present. LACERTILIA (Lizards).

Limbs four in number, body short and broad; no teeth present; ribs and vertebral column expanded to form a bony shell. CHELONIA (Turtles).

Order **Ophidia.**

KEY TO LOCAL FAMILIES OF ORDER OPHIDIA.

Maxillary bones long; no pit between the eye and nostril; no erectile fang in maxillary bone. COLUBRIDÆ.

Maxillary bones short; a pit between the eye and nostril; an erectile fang in each maxillary bone. CROTALIDÆ.

Family **COLUBRIDÆ.**

This family is represented in Allegheny County by eleven genera, and includes all the non-poisonous snakes occurring in the State.

KEY TO LOCAL GENERA OF COLUBRIDAE.

A. Dorsal scales keeled.
- B. Anal plate divided.
  - C. Loreal plate present.
    - Scales in seventeen rows. CYCLOPHIS.
    - Scales in twenty-seven rows. COLUBER.
    - Scales in nineteen or twenty-three rows. NATRIX.

CC. Loreal plate absent.
Scales in fifteen or seventeen rows. STORERIA.
BB. Anal plate not divided.
D. Loreal plate present.
Scales in nineteen rows. EUTÆNIA.
AA. Dorsal scales smooth.
E. Anal plate divided.
F. Nasal plate single.
Scales in thirteen rows. CARPHOPHIOPS.
Scales in fifteen rows. LIOPELTIS.
FF. Nasal plates two in number.
Scales in fifteen rows; back spotted. VIRGINIA.
Scales in seventeen rows. ZAMENIS.
Scales in fifteen rows; back blue, with a yellow ring around the neck. DIADOPHIS.
EE. Anal plate not divided.
H. Nasal plates two in number.
Scales in twenty-one rows. OSCEOLA.

Genus **Carphophiops** Gervais.

1. *Carphophiops amœnus* (Say). Ground-snake.

This species appears to be rare, or at least, it escapes observation. The writer has taken it once in Allegheny County, and once in Greene County. The ground-snake lives under logs and stones. It is said to eat insects. An earth-worm was taken from the stomach of a specimen in the collection of the Carnegie Museum. The length of this snake is about ten inches.

Genus **Virginia** Baird and Girard.

2. *Virginia valeriæ* Baird and Girard. Spotted ground-snake.

The writer took a specimen of this species at Wilkinsburg, June 19, 1899. This is the only record for the occurrence of this snake in Western Pennsylvania. Its habits are said to be similar to those of *Carphophiops amœnus*. The length of this specimen is eleven inches.

Genus **Zamenis** Wagler.

3. *Zamenis constrictor* (Linnæus). Black racer.

Occurs throughout the county, but not so commonly as the other black-snake, *Coluber obsoletus*, which is found in the woods, while this species occurs chiefly in the fields. This snake feeds on small mammals, birds, and batrachians; one specimen had a weasel in its stomach.

Size large; one specimen killed near Wilkinsburg measured five feet and eleven inches in length; form slender.

Genus **Diadophis** Baird and Girard.

4. *Diadophis punctatus* (Linnæus). Ring-necked snake.

This species is found occasionally in damp or mossy woods. About a dozen specimens of this species are in the Museum collection, coming from various points in the county. The writer found ten eggs in a female specimen taken July 9, 1896. The thickness of the shell enveloping these eggs would indicate that the species is oviparous. The ring-necked snake lives under stones and logs, from which hiding-places it emerges in the evenings to hunt. The food appears to be insects and worms: one specimen contained eight beetles, another an earth-worm. Length as much as twenty inches.

Genus **Liopeltis** Cope.

5. *Liopeltis vernalis* (De Kay). Smooth-coated green-snake.

This species has not yet been taken in Allegheny County, but the writer took a specimen at Stewart Station, P. R. R., on the borders of a small swamp, which is within one hundred yards of the Allegheny County line. In Fayette and Somerset Counties it is not a rare snake, occurring chiefly on the sides and tops of the mountains. The stomach of the specimen captured at Stewart Station contained three grasshoppers. Its length is twelve and one-half inches.

Genus **Cyclophis** Günther.

6. *Cyclophis æstivus* (Linnæus). Rough-coated green-snake.

A specimen of this species was captured near Carnegie, June 17, 1897. This is the only record of this species for Allegheny County. This snake frequently climbs on bushes and vines. It is said to eat insects. The form is very slender; length about two feet.

Genus **Storeria** Baird and Girard.

KEY TO LOCAL SPECIES OF STORERIA.

Scales in seventeen rows; belly light-colored.	*dekayi.*
Scales in fifteen rows; belly red.	*occipito-maculata.*

7. *Storeria dekayi* (Holbrook). De Kay's snake.

This species occurs chiefly on hillsides in this locality, preferring the corners of rail-fences and brush-heaps. The stomachs of several specimens contained earth-worms and beetles.

At Erie this species is found on the lake-shore, hiding under drift-wood, and appears to be somewhat aquatic. It is one of the commonest snakes along the shore, but is rarer in the interior. Size small, not over sixteen inches in length.

8. *Storeria occipito-maculata* (Storer). Red-bellied brown-snake.

This species is a rare snake in this locality. The writer took a specimen, nine inches long, near Wilkinsburg, September 7, 1899. Its habits are said to be like those of *Storeria dekayi*.

Genus **Coluber** Linnæus.

9. *Coluber obsoletus* Say. Black-, or pilot-snake.

A common snake in the woods. It is our largest snake. A specimen killed at Verona measured six feet, seven inches in length. In captivity it feeds on mammals, birds, and batrachians.

In the Museum collection are two sets of eggs of this species; one containing twelve eggs, the other fourteen eggs. These eggs were removed from the snakes. The writer found a set of twenty-one eggs of this species at the side of a stump, near Wilkinsburg, September 5, 1899. The eggs were buried about two inches deep in the soft earth on the south side of the stump: twelve of these eggs hatched out during the 15th, 16th and 17th of September, 1899.

Genus **NATRIX** Laurenti.

KEY TO LOCAL SPECIES OF NATRIX.

Body striped longitudinally; scales in nineteen rows.	*leberis.*
Body with color in blotches; scales in twenty-three rows.	*sipedon.*
Body with both stripes and blotches; scales in nineteen rows.	*kirtlandi.*

10. *Natrix leberis* (Linnæus). Leather-, or striped water-snake.

This is a very common snake, and is found along all of our streams, lying under stones and logs on the banks. It is a very gentle snake, and can scarcely be provoked to bite. This is in strong contrast to *Natrix sipedon*, which will strike on the slightest provocation. In its stomach crayfish are most frequently found, also occasionally fish and small frogs. The length of adult specimens may reach thirty inches. The form is slender. I have found the young to number from six to twelve. They are born about September 1st.

11. *Natrix sipedon* (Linnæus). Spotted Water-snake.

This species occurs about as commonly as *Natrix leberis*, and in the same situations. In fact it is not an unusual occurrence to find both

species under the same stone, or log, along the banks of any of our creeks, in which the water is not polluted to such an extent as to kill off the crustaceans, fish, and batrachians, on which these snakes feed. This snake, while absolutely non-poisonous, is very aggressive, and is greatly feared by many people, who confuse it with the moccasin, a poisonous snake, which does not occur in this State. *Natrix sipedon* attains a length of four feet, and is of a heavy build. The writer has found the young to vary in number from eight to forty-six. The latter number was taken from a female forty-three inches in length.

12. *Natrix kirtlandi* (Kennicott). Kirtland's Snake.

This rare snake, unlike the other species of *Natrix*, is found chiefly in the woods. The writer took a specimen at Coraopolis, June 11, 1897. This is the only record of the capture of this snake in western Pennsylvania. The specimen was fourteen inches in length, of a docile nature, and it freely ate slugs in captivity. It contained six partially developed embryos, and, judging from the thinness of the surrounding membrane, the species must be oviparous.

This species is not rare in some parts of Ohio. A collection made near Columbus by Richard Beale contained eleven specimens of this snake.

Genus **OSCEOLA** Baird and Girard.

KEY TO LOCAL VARIETIES OF *Osceola doliata* (LINNÆUS).

a. Body with twenty-two to twenty-six pairs of black rings, inclosing an incomplete red ring, which extends to the edge of the ventral plates. *Osceola doliata.*

b. Body marked by quadrate blotches, arranged in one large dorsal row, which does not extend to the ventral plates, and two rows of smaller blotches just above the ends of the ventral plates. *Osceola doliata triangula.*

13. *Osceola doliata* (Linnæus). Milk-snake.

Mr. Edward Davis collected a specimen of this species, in Lower St. Clair Township, during the summer of 1894. This is the only Western Pennsylvanian record for this snake.

14. *Osceola doliata triangula* (Boie). Milk-, or house-snake.

It is found commonly, and owing to its bright colors, and sociable habits, is a much observed species.

Mr. Omar T. Cruikshank of Wilkinsburg had a small specimen of this species, which he observed swallowing a young *Natrix leberis* almost as long as itself.

It is said to drink milk, but repeated attempts by the writer to induce it to do so in captivity have failed; mice being the only food

it would take. The house-snake sometimes reaches a length of four feet in this locality. It is oviparous. A set of twelve eggs of this species was found in an old sawdust-pile, August 30, 1899.

Genus **Eutænia** Baird and Girard.

KEY TO LOCAL SPECIES OF EUTÆNIA.

Light stripe on third and fourth rows of dorsal scales, counting from the ventral plate. *saurita.*
Light stripe on the second and third rows of dorsal scales. *sirtalis.*

15. *Eutænia saurita* (Linnæus). Ribbon-snake.

This species occurs commonly around Aspinwall, but is rarely met with in other parts of the country. This localized distribution is not explained by any difference in the character of the country. This snake is one of our most beautiful, as well as most active species. It is very gentle in disposition, and does not bite under any circumstances.

Beetles, crickets, and tadpoles have been found in their stomachs. It may reach three feet in length, and is very slender.

16. *Eutænia sirtalis* (Linnæus). Garter-snake.

This is our most abundant snake, occurring almost everywhere. When attacked it defends itself with a great show of bravery, but when caught it soon loses its aggressiveness. It feeds on batrachians almost entirely, chiefly on the common toad, *Bufo lentiginosus americanus* of which it eats a great number; a large garter-snake in captivity ate six medium-sized toads in four days. It may reach a length of three feet, and is of a heavier build than the Ribbon-snake, *Eutænia saurita.*

I have found the young to vary in number from twelve to forty-nine, depending largely on the size of the female. They are usually born in the latter part of August, or early in September.

Besides the species there are three subspecies of *Eutænia sirtalis* found within the limits of Allegheny County. These subspecies intergrade with each other, and, although typical specimens of the different subspecies appear distinctly different, there are specimens, which are very hard to classify.

17. *Eutænia sirtalis dorsalis* Baird and Girard. Garter-snake.

The writer took an adult specimen of this subspecies near Coraopolis, on the bank of a small creek, August 13, 1899. It is twenty-four inches long, and has a distinct black border on each side of the median dorsal

stripe, which is broad and conspicuous. This is the only record at hand for this subspecies within the county.

18. *Eutænia sirtalis ordinata* (Linnæus). Garter-snake.

This subspecies is met with occasionally. There are a number of specimens of this subspecies in the collection of the Carnegie Museum, coming from widely different points in the county. It is smaller than *Eutænia sirtalis,* and not so heavy in build. In captivity its habits are about the same as those of the other species.

19. *Eutænia sirtalis semifasciata* Cope. Garter-snake.

There is a specimen in the collection of the Museum, taken by the writer at McKee's Rocks, September 14, 1900, which is referable to this subspecies. In many specimens the spots extend into the median dorsal stripe, but in the present specimen they meet, giving it a banded appearance.

Family **CROTALIDÆ.**

This family is represented in western Pennsylvania by three genera, each represented by a single species, and includes all the poisonous snakes occurring in the State. Only one of these species occurs at the present time in Allegheny County.

KEY TO LOCAL GENERA OF CROTALIDÆ.

A. Tail having no rattle; scales in twenty-three rows. *Ancistrodon.*
AA. Tail having a rattle.
  B. Head with the nine normal head-shields *Sistrurus.*
  BB. Head having vertical and occipital head-shields replaced by numerous small scales. *Crotalus.*

Genus **Ancistrodon** Beauvois.

20. *Ancistrodon contortrix* (Linnæus). Copperhead.

This is the only species of poisonous snake found in Allegheny County at the present time. It is not rare in some localities, where its retiring disposition and powers of concealment have preserved its existence for many years, after both species of rattlesnakes have become extinct. It can easily be recognized by its thick body, triangular copper-colored head, the pit between the eye and the nostril, vertical elliptical pupils, and the pair of erectile fangs in the upper jaw.

While the copperhead is a sullen and treacherous snake, its disposition is to remain concealed, and it will not strike unless closely pressed, or trod upon. It is of a sluggish nature, unable to crawl rapidly, and seems to prefer the evening to hunt for food. In captivity they obstinately refuse to eat, but will drink water readily. Slugs, birds and

mice, have been found in their stomachs, and one specimen contained five larvæ of a species of cicada. A female kept in the laboratory of the Museum gave birth to six young, August 28, 1900. The young are poisonous at an early age. One of these young, when eight days old, bit the writer on the finger and caused a painful inflammation which persisted for four days. The copperhead probably never exceeds three feet in length. The longest specimen in the collection of the Museum measures thirty-four inches.

Genus **Sistrurus** Garman.

21. *Sistrurus catenatus* (Rafinesque). Prairie-rattlesnake.

This species is extinct within the limits of the county. Mr. Samuel F. Watson has the skin of one of these rattlesnakes, which he killed at Bakerstown during the summer of 1866. Two specimens of this species were collected near Butler, Butler County, Pennsylvania, September 2, 1899. It is a small, dark-colored snake, not over three feet in length, of a sluggish disposition, and not nearly so dangerous as the banded rattlesnake.

Genus **Crotalus** Linnæus.

22. *Crotalus horridus* Linnæus. Banded, or Mountain-rattlesnake.

This species is also extinct within the limits of the county. There is no positive proof that this species ever existed here. However, many years ago, rattlesnakes were not rare in this locality; they are also reported as being large and brightly colored. The prairie rattlesnakes, *Sistrurus catenatus*, could never have been common here, owing to the absence of large swamps and lowlands. Moreover, it is neither large nor brightly colored. For the above reasons the banded rattlesnake is admitted to this list. *Crotalus horridus* is found commonly in many parts of Westmoreland County. It attains a length of five feet, and its bite is very dangerous. A specimen in the collection of the Museum has a young rabbit in its stomach.

Order **Lacertilia.**

KEY TO THE LOCAL FAMILIES OF LACERTILIA.

Tongue covered with close set papillæ; no bony plates underlying the epidermal scales. *Iguanidæ.*

Tongue covered with scale-like papillæ; bony plates supporting the epidermal scales. *Scincidæ.*

Family **IGUANIDÆ.**

Genus **Sceloporus** Wiegmann.

23. *Sceloporus undulatus* (Boie). Pine-tree lizard.

This species is rare and hard to find in this locality. Two specimens are in the collection of the Museum from Moon Township, one from Dravosburg, and two from Wilmerding. One was collected near Wilkinsburg in August, 1897. This lizard is hard to see when flattened on a fence-rail, and also hard to catch on account of its marvelous activity. The dorsal scales of this lizard are keeled.

Family **SCINCIDÆ.**

Genus **Eumeces** Wiegmann.

24. *Eumeces fasciatus* (Linnæus). Blue-tailed lizard.

Two specimens of this species were taken in a woods near Wilkinsburg, August 17, 1899, and October 3, 1899. These are the only records of this species for Allegheny County at hand. The dorsal scales of this lizard are smooth.

Order **Chelonia.**

KEY TO LOCAL FAMILIES OF CHELONIA.

A. Skin leather-like; not laid off into definite areas by horn-like epidermal plates. *Trionychidæ.*

AA. Skin horn-like; laid off into definite areas by epidermal plates.
- Marginals, twenty-four; plastron of nine bones; tail long. *Chelydridæ.*
- Marginals, twenty-four; plastron of eight bones; tail short. *Kinosternidæ.*
- Marginals, twenty-five; plastron of nine bones; tail moderate. *Testudinidæ.*

Family **TRIONYCHIDÆ.**

KEY TO LOCAL GENERA OF TRIONYCHIDÆ.

Nostril with no papilla projecting into the lumen from the septum. *Amyda.*
Nostril with a papilla projecting into the lumen from the septum. *Aspidonectes.*

Genus **AMYDA** Agassiz.

25. *Amyda mutica* (Le Sueur). Spineless soft-shelled turtle.

A specimen of this species was taken at Neville Island, May 27, 1899. It must be very rare here.

Genus **ASPIDONECTES** Wagler.

26. *Aspidonectes spinifer* (Le Sueur). Spiny soft-shelled turtle.

Also a rare species. A small specimen of this species was collected on the banks of the Monongahela River above McKeesport, August 27, 1898. Soft-shelled turtles are caught along the river occasionally, but no specimens are at hand to show to which species they belong. *Aspidonectes spinifer* is a common turtle along the upper part of the Monongahela River.

Family CHELYDRIDÆ.

This family is represented by one genus in Allegheny County: *Chelydra*.

Genus **Chelydra** Schweigger.

27. *Chelydra serpentina* (Linnæus). Snapping-turtle.

This is a common species in the rivers, and is also found in the ponds and large creeks. It is highly prized as an article of diet. Sometimes it attains a great size; a specimen caught at Erie in June, 1900, weighed forty-two pounds.

Family KINOSTERNIDÆ.

KEY TO LOCAL GENERA OF *Kinosternidæ*.

Plastron not nearly filling up the opening in carapace; anterior lobe slightly movable. *Aromochelys*.

Plastron almost filling up the opening in the carapace; anterior and posterior lobes movable. *Kinosternon*.

Genus **Aromochelys** Gray.

28. *Aromochelys odorata* (Bosc). Musk-turtle.

Several specimens of this species have been taken along the rivers. There is a small specimen in the Museum collection, which was taken in an ice-pond near Etna, June 17, 1900.

Genus **Kinosternon** Spix.

29. *Kinosternon pennsylvanicum* (Gmelin). Mud-turtle.

This species appears to be very rare in this locality. A small specimen was taken in a pond near McKee's Rocks, May 29, 1900. Probably the lack of suitable ponds is responsible for the scarcity of this species here.

Family TESTUDINIDÆ.

KEY TO LOCAL GENERA OF THE *Testudinidæ*.

A. Plastron, bridge, and carapace firmly and immovably sutured together.

B. Alveolar surface of upper jaw with a median ridge. *Chrysemys*.

BB. Alveolar surface of upper jaw without a ridge.

Alveolar surface broad. *Graptemys.*
Alveolar surface narrow. *Clemmys.*
AA. Plastron hinged; freely movable; closes the opening of carapace almost entirely. *Terrapene.*

Genus **Chrysemys** Gray.

30. *Chrysemys marginata* Agassiz. Pond-turtle.

Common in all of the ponds; also found in some of the creeks which have deep water in them at intervals. It lays six or eight eggs in the soft earth on the banks of the ponds during June. This turtle in captivity readily eats meat and insects. The length of the plastron is sometimes eight inches.

Genus **Graptemys** Agassiz.

31. *Graptemys geographica* (Le Sueur). Map-turtle.

This species is rare in Allegheny County. A small specimen was taken on the bank of the Allegheny River at Verona, August 17, 1898. At Erie this was one of the commonest turtles found on the peninsula.

Genus **Clemmys** Wagler.

KEY TO LOCAL SPECIES OF CLEMMYS.

Carapace smooth; dark colored, with small yellow spots distributed more or less plentifully over it. *guttatus.*
Carapace rough, with fine concentric lines on each epidermal plate. *insculptus.*

32. *Clemmys guttatus* (Schneider). Speckled turtle.

Mr. J. L. Graf and the writer took three specimens of this species in a small swamp near Claremont early in April, 1900. This swamp is dry during a large part of the summer, which would indicate terrestrial habits on the part of this species at certain seasons of the year. Another specimen was collected at Elizabeth during July, 1900. This specimen is in the Museum collection. It was swimming in the shallow water of a small pond when first seen.

33. *Clemmys insculptus* (Le Conte). Sculptured turtle.

This species has been taken on two occasions, near Natrona, by Mr. J. A. Shafer. One of these specimens is in the Museum collection. These are the only records of the occurrence of this species in Allegheny County. Mr. S. N. Rhoads collected two specimens in Westmoreland County.

Genus **Terrapene** Merren.

34. *Terrapene carolina* (Linnæus). Box-turtle.

This species occurs sparingly throughout the county. It is entirely terrestrial in its habits, seeming to prefer dry hill-tops in the summer, but resorting to swamps in the fall to hibernate. Its eggs are from four to eight in number. They are laid in July. In captivity the box turtle will eat both animal and vegetable matter.

V. OSTEOLOGY OF THE HERODIONES.

By Dr. R. W. Shufeldt.

(Two Plates, V–VI, and 43 Figures in the Text.)

Introduction.

Ten or twelve years ago, as stated in the body of this contribution, I published my memoir on "Osteological studies of the subfamily Ardeinæ," and it appeared in two consecutive issues of *The Journal of Comparative Medicine and Surgery* of New York City. My material was somewhat limited at that time, however, and the place in which the memoir appeared prevented its being seen except by a very limited number of comparative osteologists. This being the case, the utility of the paper was to a great extent restricted, and it failed to be of the use to those interested in the osteology of birds that it might otherwise have been, had it appeared in some medium more distinctly devoted to such subjects. The work accomplished by me in the osteology of the Herons in that paper is incorporated in large part in the present contribution, but it has been almost entirely rewritten, and greatly augmented through my researches upon far more extensive material than I commanded at the time when my first work in the group was attempted.

Moreover, the present contribution aims to present the osteology of the entire suborder of the American Herodiones, and that in a comparative way, dealing with the representatives of the several genera of this country, and also with some of those of foreign avifaunæ. It also offers the taxonomical schemes of not a few distinguished writers who are authorities on the subject of the classification of birds. Finally at the close of the contribution is added the writer's individual opinion as to the probable place of the *Herodiones* in the system. It is hoped that a work, with which so much pains has been taken, so much material examined, digested, and illustrated, will prove helpful to the avian osteologist in particular and students of comparative osteology in general. Should this prove to be the case my object will have been attained, and my labor more than repaid.

R. W. S.

Washington, D. C., 5th Oct., 1900.

OSTEOLOGY OF THE HERODIONES.

The Herodiones are fairly well represented in the avifauna of the United States. For instance, in the family *Plataleidæ*, we find *Ajaja ajaja*, or the Roseate Spoonbill, a species now nearly exterminated in this country. Of the family *Ibididæ*, or the Ibises, we have two genera, each containing two species, namely *Guara alba*, *Guara rubra*, and *Plegadis autumnalis* and *P. guarauna*. The family *Ciconiidæ* is represented only by the Wood Ibis (*Tantalus loculator*), though it has been claimed by some that the Jabiru (*Mycteria americana*) has been known to occur on this side of the Mexican border. Of the Bitterns and true Herons we have quite a number. The former are represented by two genera, *Botaurus* and *Ardetta* and three species, *B. lentiginosus*, *A. exilis* and *A. neoxena*; while the latter are contained in the two genera *Ardea* and *Nycticorax*. Of *Ardea* there are nearly a dozen species, known as Herons and Egrets. *Nycticorax* contains two Night Herons, namely *N. n. nævius*, and *N. violaceus*. With the material that has been kindly loaned me by the U. S. National Museum, added to what is to be found in my own collection, I have this group, osteologically, well-exemplified. My chief regret, however, is that, at the present writing, I have not a complete skeleton of the Spoonbill, and only a sternum and shoulder-girdle of the Jabiru. During the past few years thousands upon thousands of Spoonbills have been slaughtered in Florida for the markets, by the most unprincipled of "feather-hunters" to gratify the demands of a barbarous fashion. The bodies of those birds are allowed to rot in the heronries where they are shot, stacked up in heaps,—yet for two years I have tried to secure even one skeleton for my present purpose, without success.

Overlooking all the classifications prior to 1867, we find Huxley in his taxonomy of Birds placing the three families, *Ardeidæ*, *Ciconiidæ* and *Tantalidæ* (Ibises and Spoonbills) in his group 3 or the *Pelargomorphæ* of his third Suborder, or the DESMOGNATHÆ, while Garrod in 1874 arranged them as follows:

Order III. CICONIIFORMES.

Cohort (α) Pelargi.		
(β) Cathartidæ.		
(γ) Herodiones.		
(δ) Steganopodes.	Family	1. Phæthontidæ.
		2. Pelecanidæ.
		3. Phalacrocoracidæ.
		4. Fregatidæ.
Cohort (ε) Accipitres.	Family	1. Falconidæ.
		2. Strigidæ.

In 1880, the eminent ornithologist, Dr. Sclater, published a classification of Birds in *The Ibis*, and in it we find the "Herodiones" (Order VII), containing the three families, *Ardeidæ*, *Ciconiidæ* and *Plataleidæ*, and standing between the orders Steganopodes and Odontoglossæ. This is the prevailing opinion, and is very probably close to the truth, though some would be inclined, as Professor Newton, to bring them nearer to the Accipitres than to the Steganopodes, on account of the Storks, as they may be, perhaps, considered the point of departure from the Herodiones for the Accipitres.[1]

Dr. Reichenow in 1882 in his "Die Vögel der Zoologischen Gärten," arranged these families in the following manner:

Order VII. GRESSORES.
Family 26. Ibidæ.
27. Ciconidæ.
28. Phœnicopteridæ.
29. Scopidæ.
30. Balænicipidæ.
31. Ardeidæ.

And they were by him placed between the CURSORES and GYRANTES, or in his serial arrangement of families, *directly* between the *Pteroclidæ* (family 25) and the *Dididæ* (family 32). This view is quite unique, and probably quite as unnatural.

Doctor Coues in his "Key" places the HERODIONES as an order, between the Orders LIMICOLÆ and ALECTORIDES—the last containing the Cranes, Rails and their Allies. The Herodiones he divides into the four families *Ibididæ*, *Plataleidæ* (of a suborder IBIDES), *Ciconiidæ* (of a suborder PELARGI), and the *Ardeidæ* (of a suborder HERODII). This essentially agrees in some respects with what we find in "The A. O. U. Code and Check List of N. A. Birds," which classifies this group as follows:

ORDERS.	SUBORDERS.	FAMILIES.
ODONTOGLOSSÆ		Phœnicopteridæ.
HERODIONES.	Ibides	Plataleidæ. Ibididæ.
	Ciconiæ.	Ciconiidæ.
	Herodii	Ardeidæ.
PALUDICOLÆ.	(With its divisions.)	

Stejneger places the "Herodii" (Order IX) between the Chenomorphæ (Order VIII) and the Steganopodes (Order X), and divides them thus:

[1] NEWTON. *Encyclo. Brit.*, 9th ed., Vol. XVIII, Art. "Ornithology," p. 47.

ORDER.	SUPERFAMILIES.	FAMILIES.
HERODII	Ibidoideæ	Ciconiidæ.
		Scopidæ.
	Ardeoideæ	Balænicipitidæ.
		Ardeidæ.

Dr. Max Fürbringer in his great work which appeared in 1888 gives us the following as a part of his scheme of the classification of birds, where the Herodiones fall into the Subclass ORNITHURÆ.

ORDER.	SUBORDER.	GENS.	FAMILY.
Pelargornithes.	ANSERIFORMES.	GASTORNITHES, ANSERES or LAMELLIROSTRES.	Gastornithidæ. Anatidæ.
	PODICIPITIFORMES.	ENALIORNITHES.	Enaliornithidæ.
		HESPERORNITHES.	Hesperornithidæ.
		COLYMBO-PODICIPITES.	Colymbidæ. Podicipidæ.
	CICONIIFORMES.	PHŒNICOPTERI.	Palæolodidæ. Phœnicopteridæ.
		PELARGO-HERODII.	Plataleidæ or Hemiglottides. Ciconiidæ or Pelargi. Scopidæ. Ardeidæ or Herodii. Balænicipitidæ.
		ACCIPITRES. (*Hemeroharpages Pelargoharpages.*)	Gypogeranidæ. Cathartidæ. Gypo-Falconidæ.
		STEGANOPODES.	Phaëtontidæ. Phalacrocoracidæ. Pelecanidæ. Fregatidæ.

In the part "Aves" of Bronn's Thierreich, Doctor Hans Gadow offers the following arrangement for the main divisions of the Class:

CLASS AVES.

1. UNTERCLASSE. ARCHÆORNITHES.
2. Unterclasse. NEORNITHES.

1. Division.	Neornithes	Ratitæ.
2. Division.	Neornithes	Odontoleæ.
3. Division.	Neornithes	Carinatæ.

			Ordnungen.
1. Brigade.	1. Legion.	Colymbomorphæ.	Ichthyornithes. Colymbiformes. Sphenisciformes. Procellariiformes.
	2. Legion.	Pelargomorphæ.	Ciconiiformes. Anseriformes. Falconiformes.
2. Brigade.	1. Legion.	Alectoromorphæ.	Tinamiformes. Galliformes. Gruiformes. Charadriiformes.
	2. Legion.	Coraciomorphæ.	Cuculiformes. Coraciiformes. Passeriformes.

Doctor Sharpe[1] places the PELARGIFORMES (Order XX) between the GRUIFORMES (Order XIX) and the PHŒNICOPTERIFORMES (Order XXI) and classifies them in the following manner:

ORDER.	SUBORDER.	FAMILIES.
Pelargiformes.	Ardeæ.	
	Ciconii.	
	Balænicipitides.	
	Scopi.	
	Plataleæ	Plataleidæ.
		Ibididæ.

Upon comparing the views as to the position of the Herodiones in the system, as expressed in the classifications of these various distinguished authorities, it will be observed that Professor Huxley and Dr. Sclater practically agree in their propositions, while a greater or less degree of variance is seen to obtain with respect to all the others.

In July, 1889, the present writer published in *The Journal of Comparative Medicine and Surgery* (New York) a brief illustrated article entitled "Osteological Studies of the Subfamily Ardeinæ," which contained some considerable information on the skeletology of the Herons. The body of this memoir is herewith republished with its figures, as an initial groundwork for the present contribution. Later on I will supplement it with comparative descriptions of such other materials as have fallen into my hands since it was written. In the paper named the species selected for description was the Great Blue Heron (*Ardea herodias*), and after reciting the work done with the Herons by other authors, the osteology of this species was substantially given in the following words:

Of the Skull of Ardea herodias.—Upon superior view of the skull of this Heron, our attention is first directed to its long, narrow, and sharp-pointed bill. This has the outline of a lofty isosceles triangle, of which the base is the line made at the site of the cranio-facial angle, and its apex, the tip of the beak. This surface is pierced in several localities, notably near the apex, and in front of the nostrils, by minute foramina, while its sides and ridge are venated. The osseous culmen, owing to a linear depression on either side passing forward from the nostril, is in midregion semi-cylindrical, which convex surface is continued on the apex, while above the nostrils and the precranio-facial region, though still convex, it is broader and flatter. The

[1] *A Review of Recent Attempts to Classify Birds.* Budapest, 1891, p. 75.

narial apertures are seen from this view, but their true form can best be described from a lateral aspect of the skull.

Across the cranio-facial articulation there is seen a transverse, depressed tract, some three or four millimeters wide, where mesially, the remains of the naso-premaxillary suture is still observable in the adult. This transverse tract is quite thin, and owing to the fact that the ethmoid stops abruptly behind it, beneath, on a line with its posterior boundary, it allows considerable movement in the vertical plane of the bill on the remainder of the skull. How free this is in life I cannot at this moment say, as I have not a Blue Heron in the flesh before me. This depression fixes the boundary very definitely between the frontal and postero-superior region of the upper mandible, and were it not for it, these two surfaces would be continuous, gradually merging into each other, which in fact they almost appear to do. The frontal region is broad between the superior margins of the orbits, faintly venated, and depressed longitudinally in the middle line.

In the skulls of *Sula bassana* and *Pelecanus fuscus*, specimens of which I have before me, this region is likewise very broad, but the median depression does not exist, it being but faintly marked in the parietal region in these birds.

Upon upper view of the skull of this Heron, we may also see the superior aspects of the long and large lacrymals. They fit closely to the sides of the frontals, and anteriorly encroach upon the external borders of each nasal.

The posterior orbital margins are pierced by a few minute foramina on either side, into which lead the larger venations coming from the parietal eminences. These latter are quite strongly marked here as they are in other Herons. Among the Pelicans and Gannets, however, this region is not thus distinguished. Still more posteriorly on this aspect we observe the very broad fossa on either side, known as the "crotaphyte fossa." The anterior margin of these fossæ passes directly across the skull, being simply interrupted in the middle line by a small triangular jog, with its apex directed backwards and continuous with the median line dividing the fossæ. Laterally, these fossæ pass out between the sphenotic and squamosal processes, occupying the entire space. Posteriorly they are bounded by the supra-occipital line, and a muscular line, on either side, leading to the squamosal process. (Fig. 1.)

This description of the crotaphyte fossæ of *Ardea herodias*, answers

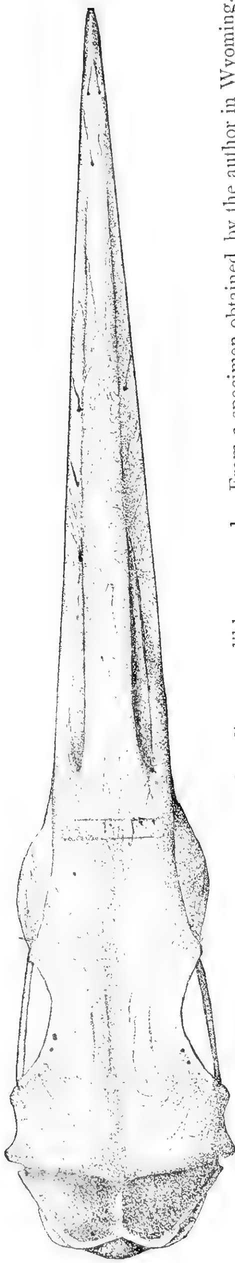


FIG. 1. Superior aspect of the skull of *Ardea herodias*, mandible removed. From a specimen obtained by the author in Wyoming. Same skull used for the figures of this Heron throughout the memoir.

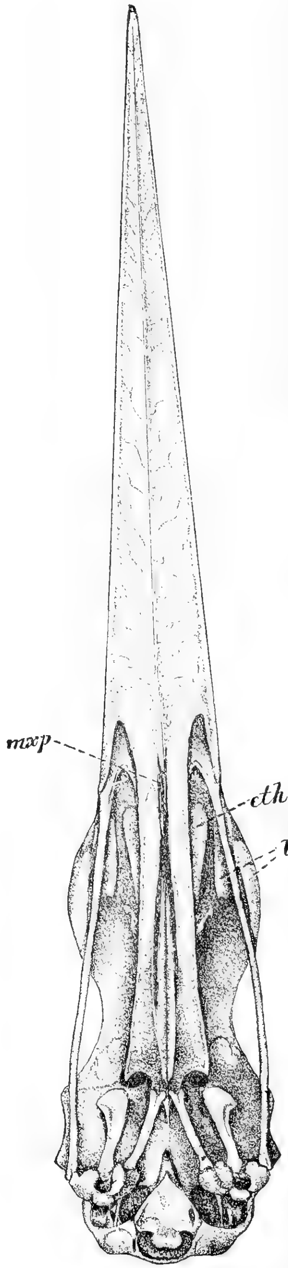


FIG. 2. Inferior view of the same, *mxp*, maxillo palatine; *eth*, ethmoid; *l*, lacrymal. Mandible removed. Both slightly reduced.

with equal exactness for the same depressions as found in *Ardea candidissima*, a specimen of which I have before me. In the Yellow-Crowned Night Heron, their forms differ materially, (Fig. 29), as well as their position. We observe in this species that these depressions are separated from each other in the median line by quite a broad isthmus, which meets the apex of the supra-occipital line. The region below this latter, presents a prominent, though rounded median crest. In the Night Heron, (*N. violaceus*), too, it can be said, that they are more on the posterior aspect of the skull, than on top. This fact is better appreciated by comparing the lateral aspects of the skulls of the two birds. (Figs. 1 and 28.)

I omitted to point out in passing the difference between the Blue Heron and *Nycticorax violaceus* in so far as the cranio-facial region is concerned, as seen upon this view. Referring to Fig. 3, we will see that the transverse depression described for the Blue Heron is not present in the Yellow-Crowned Heron, the region in the latter being occupied by a shallow concavity. The articulation is quite free, however, in the dried skull, and the relations of the mesethmoid are about the same as in the Blue Heron.

The skeleton of *Nycticorax violaceus* that I am using, is not that of an adult bird—it being "a bird of the year," which I collected at New Orleans, Louisiana, in July, 1883. But since this description was written I have come into possession of several skeletons of adults, and upon examination of them I find they fall within the account here given of the osteology of this species.

Upon a lateral view of the skull of the Blue Heron, the venated markings of the superior mandible become more evident, and the line leading forward from the anterior point of the nostril, is distinctly seen. As we would naturally be led to expect, the inferior and outer border of this mandible is a sharp cutting edge, from the point when it commences by the maxillary, all the way to the apex, and the bill as a whole tapers gradually from its base to this latter point.

The outline of the nostril is semi-elliptical, with a broad shelf of bone extending inwards from its lower margin, and becoming continuous with the general outside surface of the mandible, anteriorly. This shelf does not meet the fellow of the opposite side, as it very nearly does in the Yellow-crowned Night Heron. Behind, these shelves of bone are directly continuous with the maxillo-palatines. Above them, no nasal septum is present, and an aperture exists to the

extent shown in Fig. 2. All traces between the *nasal* and contiguous bones have been absorbed, still such is the conformation of the skull, that one could predict with no little certainty, where their original sites were. Coues (Key, 2d Ed., p. 647) states that the "nasal bones are typically holorhinal" in the Herons, and so they are, according to the rule laid down by Garrod for deciding that question, that is, where "a transverse straight line drawn on the skull from the most backward point of the external narial aperture of one side to that of the other, always passes in front of the posterior terminations of the nasal processes of the premaxillæ." (P. Z. S., 1873, p. 35.) This rule, perhaps, will hold better as a guide, than the form the nasal bone assumes, for in this Heron there is an evident tendency on the part of its nasal towards schizorhinalism, its posterior narial margin, at least, being evidently distinctly angular, more so even than in *Daption capensis*, the skull of which Garrod figured, and which seems to have a similar tendency. So far as form is concerned, I observe the typical holorhinal skull in the *Gallinæ* generally—where the above noted rule also holds equally good.

Such *single* characters are of great service sometimes, to assist merely in determining a bird's position in the system, but it is hard for me to see how one could think of basing a classification upon such a trivial condition any more than we could upon the shape of the beak itself. Moreover, it would be of little use in such forms as *Sula*, where there is no nostril present, and certainly it would in some cases violently separate forms that in their general structure closely approach each other.

We find upon lateral view in *Ardea herodias*, a subelliptical aperture, that is bounded anteriorly by the nasal, posteriorly by the lacrymal, and below by the maxillary. Through it can be seen the upper parts of the maxillo-palatines. The lacrymals in this Heron are very large bones (Fig. 2); and the manner in which one articulates superiorly with the frontal and nasal has already been noted above. Anteriorly, the bone has a regularly concave margin, which bounds the aperture alluded to in the preceding paragraph. Below, a lacrymal rests rather more than its anterior half upon the maxillary, then is slightly raised above it to project backwards as a process with a transversely notched tip. Above this part of the bone there is a constriction which divides it from the larger and upper portion. The surface is smooth and the bone is highly pneumatic, air gaining access to its interior

FIG. 3. Left lateral view of the skull of *Ardea herodias*. About three-fourths natural size.

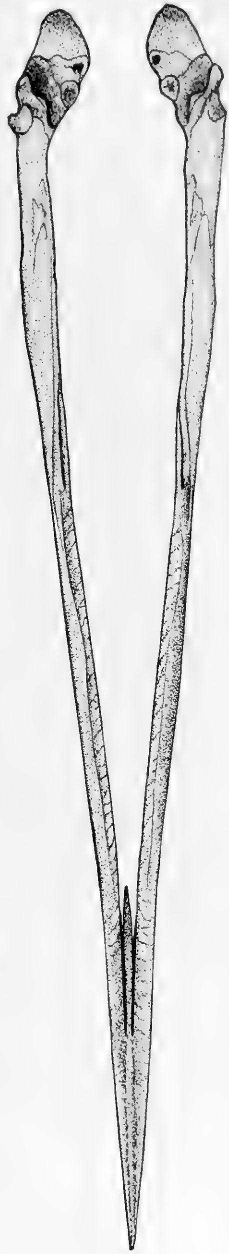


FIG. 4. Superior view of the mandible from the same skull. Reduced to about the same proportions. Drawn by the author.

through a large foramen on its mesial aspect. Owing to the broad frontals, the orbital roof is very complete, while its outer periphery is sharp and thin. This roof is quite horizontal in *Ardea*, as we see it in the Gannets, but it is inclined to be tilted up in the Night Herons, and consequently not shielding the eye so completely from above.

The ethmoid is an unusually thick and bulky bone; it spreads out a wide base for the frontals to rest upon, and its straight anterior upper margin bounds the cranio-facial hinge posteriorly; its anterior surface is broad, bearing a delicate medial crest, continued upon it from the apex of the rostrum. Its internal structure is cancellous, and air is undoubtedly admitted to permeate it throughout. At a point, on either side, half way between the rostrum and the roof, it supports a feebly developed wing, the lower spur of which meets the backward extending process of the lower and smaller portion of the lacrymal. Among such birds as the Gannets and Pelicans the ethmoid becomes lamelliform again, and it is not nearly as thick diametrically in the Night Herons as we find it in *Ardea*.

The middle third of the rostrum of the Blue Heron is a smooth cylindrical rod, which posteriorly is gradually projected from the sphenoid to merge anteriorly into the ethmoid. The inter-orbital septum is very incomplete, presenting one large vacuity, with which the foramina for the optic nerves have united, together with the smaller nervous foramina found in many birds on the outer side of the latter. Above this interorbital vacuity we note that the olfactory foramen is also very large, and the groove for the nerve leading forward from its anterior apex is faintly double. In my specimen of *Ardea candidissima* all these openings have merged into one immense aperture, permitting a full view of the interior of the brain-case. This individual is not fully matured, however, and such may not be the case in the adult Egret.

This does not hold good in the skulls of adult specimens of this Heron, for I find since writing the above paragraph, that the arrangement of these foramina in the crania of specimens of *A. candidissima* in the collection of Mr. Lucas as well as in those of this species in the U. S. National Museum, is quite as I have described it for his *A. herodias*. My thanks are due to Mr. Lucas for his courtesy in placing at my disposal the material to which I refer. From the same source I have been enabled to compare skulls of *Botaurus lentiginosus*, *B. exilis*, *Ardea occidentalis*, *A. egretta*, several of *A. candidissima*, *A. virescens*, *Nycticorax n. nævius* and *N. violaceus*, besides a few skulls and skeletons of Herons from foreign lands.

The olfactory foramen of the Yellow-Crowned Night Heron is exceedingly small, while in the specimen before me the groove for the passage of the nerve from it is single. The optic foramen, likewise, unites with the interorbital vacuity in *Nycticorax*.

The posterior orbital wall in the Blue Heron looks forwards, downwards and slightly upwards; it presents nothing of particular interest; the *foramen ovale* which pierces this wall at its lower part in many birds, has in the Herons moved round so as to appear on direct lateral view, just over the upper edge of the quadrate. Upon this aspect the dome of the parietal eminence is well seen in profile as is the crotaphyte fossa, with the muscular depression behind it.

All Herons present three processes for our examination on the side of the skull, these are, first, the squamosal process seen immediately above and rather in front of the head of the articulated quadrate; second, the sphenotic process defining the boundary of the crotaphyte valley above, and finally, another process just beyond the last, formed at the union of the outer angles of the frontal and squamosal bones.

Sutural traces among the bones composing the intraorbital bar have almost entirely disappeared; they can be made out only after careful scrutiny in my specimen of the Snowy Heron, which, as I have said, is not a fully grown bird. In the Blue Heron the line of union between the jugal and quadrato-jugal can sometimes be faintly recognized in the adult individual. This posterior third of the bar is broad and laterally compressed, and the articulation with the quadrate a substantial one, by the usual cup and process joint. The jugal division of the bone is more slender, though also laterally compressed, and the anterior end of the maxillary portion, whose relation is to be described below, is horizontally flattened, though not very broad.

Several years ago Professor Parker found a "post maxillary" in the Emu, and subsequently discovered a similar segment in several of the Herons, as *Ardea garzetta*, *Nycticorax ardeola*, and in the Bitterns, as *Botaurus viridis* and *B. stellaris*.

This post maxillary is said to be situated or found behind the angle of the maxillary. I find no such bone in the specimens of Herons before me, and can add nothing to the statements of Professor Parker given above. It may be that the post maxillary is present in *Ardea herodias* but so far absorbed in the adult as not to be recognized, or if a free bone, it has undoubtedly been lost, as my specimens have been in my collection for several years. In either case, fresh material in the flesh,

both young and adult, would be required, for me to examine and decide upon such a point.

The quadrate of the Blue Heron is a large and massive bone, and indeed, such is its character in all of the *Ardinæ* so far examined by me. Its head presents for our examination two distinct and elongated articular facets, separated by an abrupt and squarish notch. These facets occupy the inner and outer borders of the head of the bone, with their long axes parallel to the long axis of the skull; the outer one, which at the same time is slightly the larger, is in advance of the inner, a circumstance which makes it rather appear that this end of the quadrate was obliquely twisted. Anteriorly, the bone develops a broad lamelliform orbital process, which is flattened behind and convex forwards in front, and gently curved throughout, to the same degree as the posterior wall of the orbit behind it, though it does not touch the latter.

The apex of this orbital process of the quadrate is nicely rounded off, and the anterior surface immediately below its border looks almost directly forwards, a difficult thing to show in a drawing. (Figs. 2 and 3.)

Posteriorly, the shaft of the quadrate is pierced by a large pneumatic foramen, sufficiently large to permit one to see the trabeculæ spanning its hollow interior, from wall to wall. The massive foot of this bone presents for examination six articular facets. They are the following: 1. A facet upon the lateral aspect the usual cup for the ball and socket joint with the quadrato-jugal. 2. On the extreme outer side of the inferior surface, a sub-elliptical facet, separated from the remaining four by a deep valley. This facet is the largest of the group; its anterior end is innermost, and it is intended to articulate with a corresponding surface on the mandible. 3. A smaller elliptical facet, with its axis parallel to the last, situated immediately across the valley referred to above. This is the lowest facet of the group, the skull being held with its superior surface, upwards. From the outer side of this facet a concave articular surface is carried down, to extend partially across the anterior margin of the intervening valley. 4. A posterior elliptical and smaller facet, higher up on the bone than either 2 or 3, being directed somewhat backwards. A concave, narrow, articular isthmus connects this facet with No. 2, occupying the posterior margin of the intervening valley. 5. A large circular facet occupying the surface of the inner aspect of the foot of the quadrate, directed downwards, backwards and inwards, the skull being held as above. This

facet is separated from 3 by a distinct valley. 6. On the inner angle of the foot of the quadrate, a small circular facet, directed forwards and upwards, intended for the cup on the posterior extremity of the pterygoid. All these articular surfaces except the first and last, have corresponding elevations or depressions for their insertion on the articular end of the mandible, and I have risked the danger of being considered a "dweller upon details" in order to show what an extensive array of facets the foot of this bone supports, and how complicated a surface it offers to the articular extremity of the mandible. I believe, that a careful study of these facets, in the Class birds, will some day afford us an additional series of facts that can be used with advantage in classification.

The maxillo-palatines, the palatines, the pterygoids, and the condyle of the occiput, can all be seen on direct basal view, but these I have reserved to describe in the two remaining aspects of the skull.

Seen upon inferior view of the skull, the superior mandible presents an unbroken horizontal surface. This is bounded on either side by its sharp edges, while its middle and longitudinal line is defined by a delicate and slightly elevated crest. At irregular intervals on either side of the latter, minute foramina occur, from which spring branching concave venations, directed forwards and outwards to the lateral edges. (Fig. 2.)

The dentary processes of this premaxillary bone are directed backwards, with pointed apices to overlap the major part of the horizontal plate of each maxillary. Anteriorly, the palatines merge imperceptibly into the premaxillary, rendering it impossible in the adult Heron to define the exact line of union, their inner margin also uniting with each other, in a like manner, as far back as the middle point on the inferior border of a maxillo-palatine. Here abruptly an interval occurs between them, through which we may see the hinder half of the latter bones and the lower border of the vomer.

Still more posteriorly they become doubly carinated, the posterior angle of the outer keel being bluntly pointed. At the mergence of these keels behind, we find the articular heads for the pterygoids, the upper surfaces of both ride the under side of the rostrum.

Now the inner sides of the inner keels of the palatines are produced forwards to merge into the vomer in a sharp point beyond, thus forming in conjunction with this bone a long doubly carinated process, in the median line, opposite the middle thirds of the palatine bodies.

This process forms a part of the lower margin of the vomer, which, as I have said, it really is. The median plate of the vomer rises above this and extends beyond it, to project slightly into the interspace between the maxillo-palatines. The upper margin of this median vomerine plate is longitudinally split, as it were, and the two thin plates thus formed beautifully curl outwards and downwards, on either side, creating as they do so a median longitudinal groove on the upper aspect of the vomer, over the hinder moiety of which the apex of the rostrum hangs, and even, still more posteriorly, meets it in a free schindylesial articulation. The middle third of the inner border of the upper side of each palatine develops a broad crest that curls outwards all along its summit. On lateral view this crest hides the hinder half of the vomer.

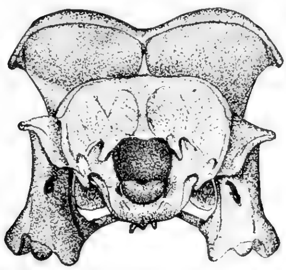


FIG. 5. Posterior view of the skull of *Ardea herodias*. Mandible removed. Natural size. By the author from the same specimen as the others.

The maxillo-palatines of *Ardea herodias* are of a highly spongy bone tissue throughout. This material imperceptibly merges into the more coarsely developed tissue of a similar character, which fills the hollow of the superior mandible beyond. Laterally, the maxillo-palatines may be said to spring from the anterior horizontal plates of the maxillaries, on either side; such a fact is only known to us though from our knowledge of the development of these bones in other birds, for we would hardly suspect it here. The hinder halves of these bones rise parallel to each other, as lofty porous plates, which being produced forwards meet the inner sides of the nasals and the premaxillary to fuse with them. In *Nycticorax* these hinder moieties have a thin outer layer of compact bone tissue covering them which more or less masks their spongy nature.

In this Heron the relations subsisting among the palatines, the vomer, the rostrum of the sphenoid and the bones just described, are about the same as we find them in *Ardea*.

In both, too, we find that the median surfaces of the upper part of the inner carination of the posterior third of the palatines are closely applied to each other, so closely in fact that in dried skulls one has to resort to the knife to separate them before we are assured that direct

union has not taken place, as we find it in the pelicans, gannets, and others, where the *entire* median surface of the inner carinal plates fuse to form one descending keel in the middle line.

My specimen of the immature Yellow-Crowned Night-Heron, shows this union to be of so firm a nature, that it would not surprise me in the least to find in an old adult of this species that perfect union had taken place between the parts of these inner keels of the palatines that come in contact behind. There is an excellent figure of the base of the posterior half of the skull of *Ardea cinerea* in Professor Huxley's memoir upon the classification of Birds in the Proceedings of the Zoölogical Society for 1867, Fig. 19, page 437.

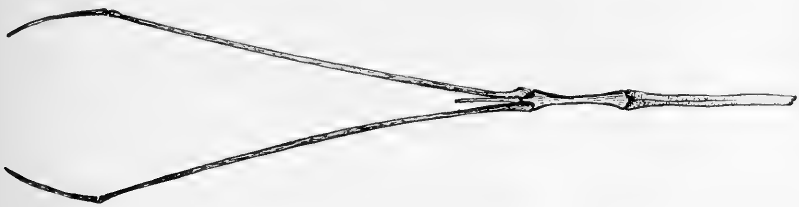


FIG. 6. The hyoid arches of *Ardea herodias*, viewed from above. Natural size, by the author from the same specimen as other figures.

It agrees in every detail with the skulls of other true Herons that I have before me, or have examined elsewhere. The pterygoid of the Blue Heron is a straight, stout bone, feebly crested upon its upper side, while its inner aspect is grooved for its entire length. Both ends are dilated, the anterior one to receive the palatine head of the corresponding side; the other to articulate with the quadrate. Above this latter extremity a projection is developed, on the outer side of which is seen a large pneumatic foramen, which is double in some specimens. This bone is devoid of any sign of a process at the usual site where one usually develops to meet the baso-pterygoid apophysis when the latter is present. Other Herons have the pterygoids constructed in precisely the same way. I fail, however, to find the pneumatic foramina in the Night Herons in the same locality as described above for *A. herodias*, but no doubt a larger series of specimens would show it, as the same projection exists in the pterygoid.

In the Blue Heron the basisphenoidal region is elongated and develops a median keel which merges into the inferior surface of the rostrum just beneath the pterygoidal heads. The Eustachian tubes are guarded only by a thin over-arching lamella of bone. As in *Sula* and

other forms the basitemporal area is much contracted, while in the dried skull the tympanic cavity is so exposed that no little care is requisite to locate its exact boundaries. The foramina for the pneumogastric, glossopharyngeal, hypoglossal nerves and internal carotid artery, relatively occupy their usual sites, as seen elsewhere in the Class.

Upon this inferior view of the skull we really see the under side of the occipital condyle, as its form and articular surface appear only in full view when the skull is looked at directly from behind.

This direct posterior view of a bird's skull is a very instructive one, a fact that was thoroughly appreciated by so talented an anatomist as Garrod, who presented us with a number of them among his valued papers, as for instance where he makes the telling comparisons among the skulls of *Chauna derbiana*, *Cloëphaga magellanica* and *Mitua tuberosa* (P. Z. S., 1876, pp. 189–200).

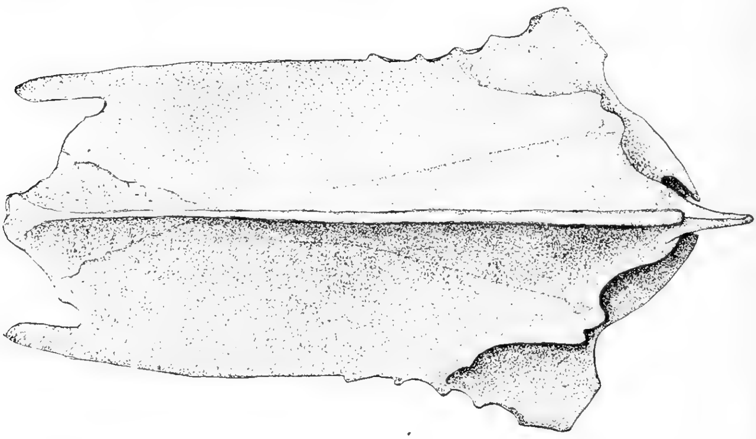


FIG. 7. The sternum of *Ardea herodias*, viewed from below. Natural size.

Such a view of the skull of this Heron is shown in Figure 5, where the broad crotaphyte fossæ are seen, separated from each other in the median line above by an exceedingly narrow space. The supra-occipital region stands out prominently, partially overhanging the subcircular foramen magnum. Regularly reniform, with the notch upwards, the large occipital condyle is here better seen, jutting directly backwards from its lower margin. Beneath, and in the middle region, the pterygoids and the four carinations of the palatines come into view. These are flanked on either side by the ponderous quadrates, which latter show the large pneumatic foramen in each, leading into their hollow interiors.

Above, on either side, the sphenotic process can be seen, pointing downwards, while below it the squamosal process juts out, and between the two, the crotaphyte fossæ pass to the lateral aspect of the skull.

In *Nycticorax* the supraoccipital region is carried to a point above, and is usually divided by a pronounced crest with rounded summit. A far broader strip separates the crotaphyte fossæ from each other in the median line.

The occipital condyle, although of the same shape, is relatively much smaller, and finally the posterior orbital peripheries can be seen peeping above the parietal domes, all these differences enumerated giving to these two skulls, even when only casually compared from this view, a very dissimilar look.

In a number of minor details, principally referable to relative position and form, the points for examination within the braincase present certain differences between the Night Herons and the genus *Ardea*.

All the essential characters in the skull of *Nycticorax n. nævius* agree with the corresponding ones in the skull of *Ardea herodias*, as they

FIG. 8. Right lateral view of the sternum of *Ardea herodias*. Natural size, and same bone as shown in Figure 7.

have been described above. The skull of the former, however, is about one-fifth less in point of size than it is in the last named species. (See FIG. 29.)

The *mandible* of the Herons offers us a number of points of interest for our investigation.

In the Great Blue Heron (a bird that I have alluded to several times above as simply the Blue Heron) the outer border of either ramus of the mandible for nearly two-thirds of the distance back from the apex is very sharp, and along the middle third of the entire length of the bone, it is swelled just within this cutting edge, which enlargement has its mesial boundary developed also as a sharp border, parallel to, but on a lower plane with, the outer ramal edge.

The inferior ramal borders are rounded for their entire lengths, merging into the gently upward curved symphysial extremity anteriorly, to be extended behind to the very ends of the articular parts, while on each side they curve towards the median plane. On the external aspect of a ramus we see numerous minute foramina arranged roughly in two longitudinal rows. Some venated markings are also present. No ramal fenestra pierces this bone, where it occurs in many other birds; but an oblique split plainly marks the site where it was sealed over during the development of the mandibular elements. This entire external surface is smooth and flat, becoming gently convex only as it sweeps beneath the articular ends behind. As I have said, the posterior third of the superior ramal border is somewhat flattened with rounded inner and outer margins. To the rear of the middle of this third, the fairly well-developed coronoid processes are seen. They consist of a series of three points in a row, on each side, one behind the other, the anterior being the largest, the other two gradually diminishing in size.

The mesial aspect of either ramus is longitudinally concave for its anterior third, while behind, it becomes flattened, to finally pass beneath the articular extremity, facing, as it does so, downwards and towards the median plane.

Viewed from above, we find the symphysis concave and more than a sixth the length of the bone. In the median line behind, between the ramal sides, it sends backwards a spike-like process, nearly 2 cm. long, which we may call the *posterior symphysial process*, this is present in *A. candidissima*, but absent in some specimens of *Nycticorax*. We also see it in very old Albatrosses.

The articular ends above, are generally concave, but two small convexities occur on the oblique line that crosses in front of the central pit. A circular pneumatic foramen is seen at about where it occurs in the majority of birds where it is present. The hinder ends of these articular extremities are obliquely truncate, (Fig. 5), the faces looking

backwards, upwards, and a little outwards. In the Yellow-Crowned Night Heron these ends are cut squarely across, and are obliquely concave. In *A. candidissima* they are very much as in the Night Herons, though deeper from above downwards, less concave, and face rather more outwardly. Otherwise the mandible of this Heron resembles in every particular the bone as found in the representatives of the genus *Ardea*.

As we might expect, it is built upon the same type also, in *Nycticorax*, differing in no very essential particular. It is proportionately shorter, stouter, and more obtuse ; the ramal vacuity is filled in here also.

There seems to be no exception to the rule that all Herons have the glossohyal of the *hyoid arches* in cartilage, (Fig. 6). Careful examination made with a good lens fails also to disclose to me the slightest trace of osseous tissue deposited in the cartilage of the cerato-hyals of adult specimens of *Ardea herodias*. This is equally true of *A. candidissima*, but in my immature specimen of *Nyctcorax* I find a distinct, though very small osseous cerato-hyal, on either side, embedded in the cartilage of the second visceral arch.

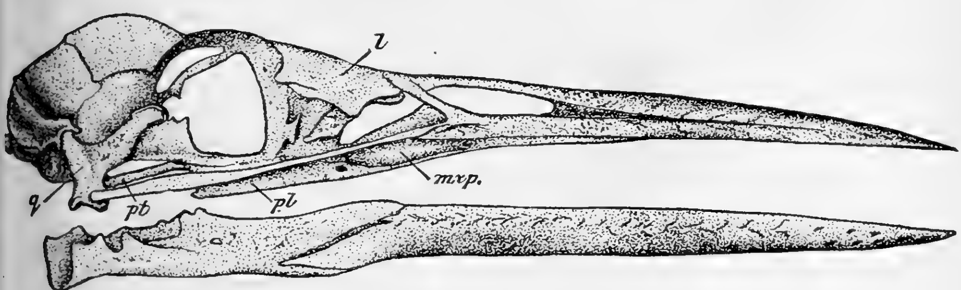


FIG. 8 *bis*. Right lateral view of the skull of *Nycticorax nycticorax nævius*. Natural size, adult ; drawn by the author from a specimen collected by Dr. Streets at San Diego, California. *q*, quadrate ; *l*, lacrymal ; *mxp*, maxillo-palatine ; *pl*, palatine ; *pt*, pterygoid.

The first basibranchial is compressed from side to side in the *Ardeinæ* generally, with the posterior aspect of the hinder end fashioned to articulate with the anterior heads of the cerato-branchials, and the head of a slender styliform second basi-branchial of no great length, which rides above them in the median line. Each cerato-branchial is a long delicate rod of bone, in old individuals often attaining a length

of 5.8 cm., while the epibranchials rarely exceed a centimetre and a-half in length, are very slight, and have their hinder ends prolonged by needle-like tips of cartilage, a condition which also obtains with the end of the second basibranchial or urohyal.

A specimen of the Snowy Egret before me has the bony parts of the ear so well preserved that I am enabled to see the elliptical stapedial plate, and the delicate bony rod of the mediostapedial part of the apparatus. The sclerotal plates of the eye are elongated and rather narrow, they average from thirteen to sixteen in *Ardea herodias*.

Before entering upon the remainder of the axial skeleton, I will take this opportunity to further say that the tracheal rings also ossify as in other birds. Comparatively, the tube seems to be of small calibre, and I think one would rather be lead to look for a larger windpipe in so big a bird.

Of the Vertebral Column; Ribs.—(Figs. 25, 26, and 27.) In the Great Blue Heron the *atlas* is not large, when taken in comparison with the size attained by other vertebræ in the column, as for instance the nineteenth. Its cup for the condyle is notched above, and on either side of the neural arch superiorly, the usual blunt processes are thrown backwards (Fig. 25).

The *axis* of this bird is a very irregular bone, and a difficult one to describe without resorting to tedious detail. For this reason I have added to my illustrations a figure presenting the appearance of this bone on direct lateral view. It will be seen that the "odontoid process" is quite large, being perfectly flat above and convex below. The centrum is deep; thinned in its center by the lateral concavities, beneath which, its lower margin is carried by a gentle curve from the articular surface at one end to the articular surface of the other. An elongated neural crest adds another curvature to the bone above. The facets of the post-zygapophyses face directly downwards, and the entire bone is much compressed from side to side. From the third to the sixth, the vertebræ are much elongated; their general pattern being seen on side view in Fig. 27. Along the median line of their neural arches above, these bones are thin and sharp. Their several articular facets are so arranged that they only permit the head to be bent forward and back again.

The neural canal in them is small and circular on section. The "vertebral canal" is present in all, being longest in the third vertebræ and shortest in the sixth; owing to the manner in which the

parapophyses assert themselves. This is done by a foramen, which exists opposite the middle of the canal in its lateral wall; this elongates in the vertebræ from third to sixth, in a backward direction until it cuts through the hinder and outer margin of the vertebral canal of the sixth vertebra. Then a long pair of parapophyses is the result, they being very short and blunt in the third, fourth and fifth vertebræ, and only become sizable in the sixth when overtaken and developed by the advance and breaking through of the foramen in the manner indicated.

A large covered "carotid canal" is seen in the seventh to the thirteenth cervical vertebræ inclusive; a slight deficiency taking place in the wall of the last, in the median line beneath (*A. herodias*). It is the most anterior part of each of these segments, and they are further characterized by being shorter and stouter than the last four described. The pneumatic foramina of these vertebræ are chiefly within the neural canal, piercing its upper wall posteriorly. From the fourteenth to the seventeenth inclusive, these vertebræ are gradually changing in form and character to resemble finally those of the dorsal region. The fifteenth is the first to show a high neural crest, with spreading diapophyses at the fore part of the vertebra, while the vertebrarterial canal increases in calibre.

The neural crests or spines of the seventeenth and eighteenth are thick and long, and interlock with each other by an extensive joint.

In the *eighteenth vertebra* we observe for the first time a free pair of pleurapophyses, with very short bodies, but still articulating by tubercula and capitula.

Professor Owen, in speaking of the movement of these vertebra of the cervical region upon one another, says: "This mechanism is most readily seen in the long-necked waders which live on fish and seize their prey by darting the bill with sudden velocity into the water. In the common Heron, for example, (*Ardea cinerea*), the head can be bent forward on the atlas or first vertebra, the first upon the second in the same direction, and so on to the sixth, between which and the fifth the forward inflection is the greatest; while in the opposite direction these vertebræ can only be brought into a straight line. From the sixth cervical vertebra to the thirteenth the neck can only be bent backward; while in the opposite direction it is also arrested at a straight line; from the fourteenth to the eighteenth the articular surfaces again allow of the forward inflection, but also limit the opposite motion to the straight line." (Anat. of Verts., Vol. 11, p. 39.)

This is precisely what I find in examining the same vertebræ in the neck of *Ardea herodias*. It can best be studied in the neck of a fresh specimen from which the skin has been removed, with the skeleton of the neck of another individual at hand for comparison.

The skeleton of the neck in *Nycticorax* differs in many particulars from that of *Ardea;* a number of these points only become evident after careful comparison, and will not be taken up in detail here. Others show a profound difference in organization, such as—the first pair of free pleurapophyses occurring on the seventeenth vertebræ instead of on the eighteenth as in *Ardea;* the third, fourth, fifth and sixth vertebræ are not elongated as in *Ardea*, but show the simple gradation in size down the cervical chain: finally, the inferior wall of the carotid canal is open in the last four vertebræ through which it passes, in *Nycticorax*, and only in the last in *Ardea herodias*.

Returning to the nineteenth vertebra in the Great Blue Heron, we find that it has a high quadrate neural crest or spine which interlocks by a free joint with the one behind; it sends down a pair of ribs that articulate with the sternum through the intervention of a pair of costal ribs. The metapophyses are short and stumpy, barely reaching beyond the transverse processes. The bone has no descending hyapophysis, though a line marks the longitudinal center of the centrum below. This fades away gradually on the remaining vertebræ. A large pneumatic foramen pierces the bone, on either side, behind the transverse process, and the cavities to which they lead seem to occupy all parts of the bone.

In the next four vertebræ we see but little change; they are all free elements; the neural spines do not decrease any in height, but they become shorter from before, backwards, shortest of all in the twenty-third or the *last free vertebra*, before we reach those united as one bone in the pelvis. Through this "dorsal region" the neural canal of a Heron is strikingly small, even small in proportion with the size of the vertebra. The transverse processes are narrower antero-posteriorly as we proceed backwards, but at the same time reach out further from the side of the vertebra As we proceed towards the pelvis we note also that the facet for the head of the rib gradually approaches the anterior part of the centrum of each vertebra, but finally does not quite reach the anterior margin of the side of the neural canal in the ultimate segment. A line joins this facet in each case, with the facet for the tubercle of the rib, which is at the outer pos-

terior angle of the diapophysis. On either side of the beam thus formed very large pneumatic openings are seen in these ultimate vertebræ, and the trabeculæ spanning the cavities within are plainly in view.

Four pairs of hæmapophyses articulate with the borders of the sternum in all of the Herons that I have thus far examined; the fifth pair not reaching this bone, but articulating with the hinder margins of the last sternal pair. The slender pair of ribs that claim this last pair of hæmapophyses articulate with the twenty-fourth vertebra and it is the first one that anchyloses to form a part of the pelvis.

The last two pairs of vertebral ribs are without epipleural appendages, and even when these processes do occur on the ribs they are very weak and freely articulated with the border. Herons have very frail ribs at the best, a fact that strikes one the moment we examine the thoracic skeleton of one of these birds.

The seventeenth vertebra having a small pair of free ribs in the Yellow-Crowned Night Heron, we find has a still longer and better developed pair on the eighteenth in this species, and yet another free pair on the nineteenth. These latter have epipleural appendages, although they do not meet the sternum by costal ribs below. This gives three pairs of free ribs to *Nycticorax*; four pairs, as in other Herons, that meet true sternal ribs; and a pair from the pelvis, to which is attached false floating ribs, or a pair of those that articulate with the hinder borders of the preceding sternal pair proper.

In *Ardea herodias* and *A. candidissima*, the second pair of free ribs support epipleural appendages, low down on the bone.

For the moment I must now be permitted to defer our further consideration of the vertebral column, until the sternum and pectoral arch have been disposed of. After that I will return to the examination of the pelvis and coccygeal vertebræ, upon the completion of which the appendicular skeleton will finally engage our attention.

Of the Sternum.—(Figs. 7, 8, 9, 31, and 32.) Upon direct pectoral view, the sternum of *Ardea herodias* is seen to be broader in front than it is behind; this is due to the projection from the former end of the large costal processes on either side, or otherwise the bone on this aspect would have a nearly regular quadrilateral figure.

The xiphoidal extremity is doubly notched—a broad triangular indentation deeply entering upon either side. This gives rise to outer xiphoidal processes, each of which point directly backwards, and have simply rounded extremities.

Evenly convex throughout, the sternal body shows but three pairs of lines upon this view—the pair of muscular lines of the pectoral

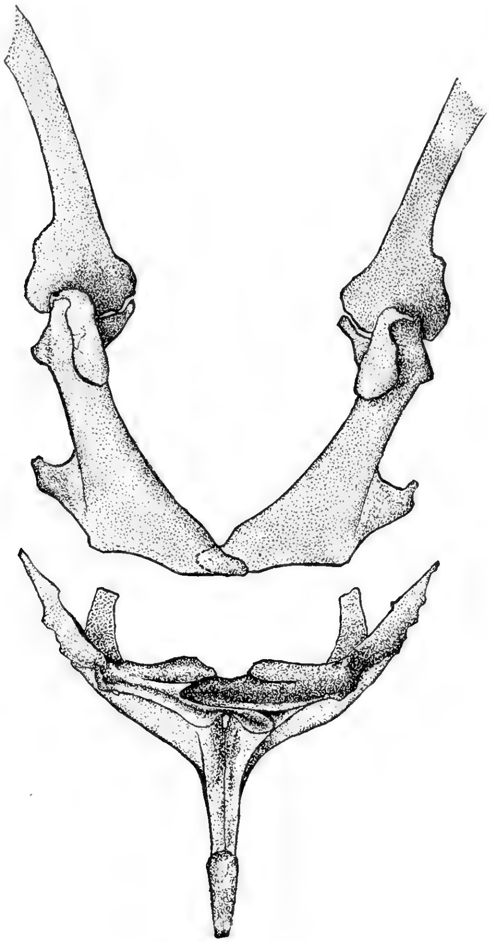


FIG. 9. Below is an anterior view of the sternum of *Ardea herodias*, showing the decussation of the coracoidal grooves. Above, lifted from their position, are the coracoids with dotted line showing the extent to which they decussate. The scapulæ are articulated above these, but the *os furcula* has been removed. Natural size, and the bones from the same specimen as Fig. 8.

muscles; the subcostal lines; and a pair, each one of which commences at the middle point of the inner border of the xiphoidal in-

dentation, to be carried forwards and inwards to the carina, meeting the hinder ends of the pectoral lines.

Anteriorly, we are enabled to see the under side of the pointed manubrium, and the coracoidal beds, and gain some idea from the dissimilarity of the parts on the two sides of the former, of the method of decussation of the latter.

The anterior third of the lateral margins of the body of the sternum show also, upon this view, the little rounded elevations indicating the position of the articular facets for the hæmapophyses.

The keel fails to reach quite to the end of the sternal body behind, but is brought far up in front, commencing immediately beneath the manubrium.

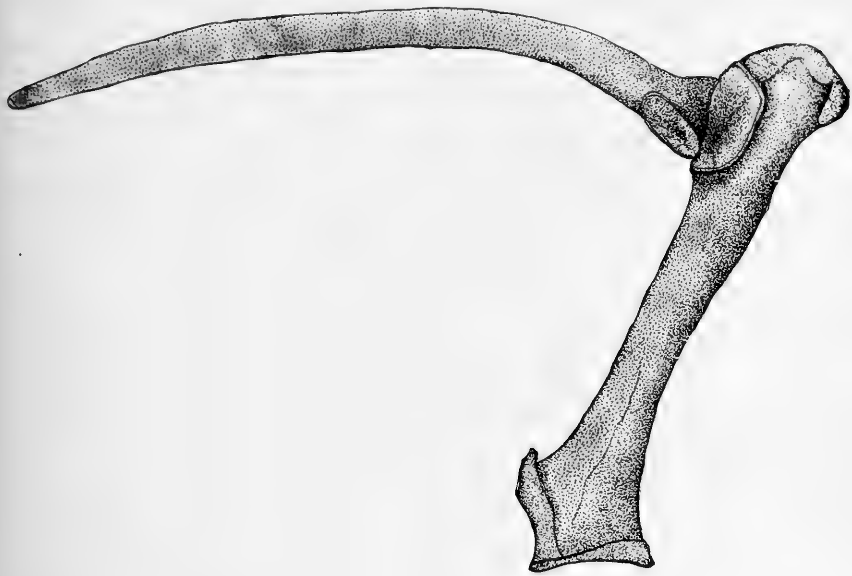


FIG. 10. Right lateral view of the coracoid and scapula of *Ardea herodias*. Natural size from the specimen.

Owing to the decussation of the coracoidal grooves, it depends upon which side of the sternum we view, as to how this part of the bone appears. In the drawing the right lateral view is presented, and in this particular specimen the coracoidal groove seems to have a deep triangular notch in it. Had we seen it the other way, the groove would appear as if it ran in one continuous belt around this anterior part of the bone.

Upon this aspect, the manubrium is seen to project directly forward as a straight process. Below it, the anterior carinal margin is sharp, being concave forwards above, and straight below. The carinal angle is rounded. Muscular lines are barely seen on the side of the keel, the surface here, as it is on the sternal body above it, smooth and polished, the bone becoming only slightly thicker anteriorly below the coracoidal beds.

The keel is bounded inferiorly by an elegantly curved margin, extending from the carinal angle to nearly the end of the sternum (Fig. 8). We are now better enabled to see the hæmapophysial facets, with the deep concavities between each and its neighbor. As in so many birds, these interarticular cavities are the favorite sites of the pneumatic foramina, and they are seen to be numerous here, occupying the bottoms of the pits. For the rest of the border behind, it is sharp and continuous with the upper border of the xiphoidal process, of which I also give a side view.

As a whole, the costal process is triangular, with its apex at the summit of the bone.

Seen directly from above the asymmetry of the two sides of the anterior border again becomes apparent, due to the method of articulation of the coracoids. A rounded notch exists in the median line, flanked by a long facet on the right of it, and one, only half the size, on the left. The manubrium is now seen to be triangular, with its surface flat and smooth.

Well within the anterior boundary of the body of the sternum, upon this superior aspect of the bone, we observe a single elliptical foramen of some size, situate in the median line, as is its major axis. This leads to cavities in the thickened part of the front of the carina, already alluded to in a paragraph above.

From anterior border to xiphoidal extremity, and from summit of costal process to summit of costal process this sternum is one general, and by no means shallow, concavity. There are no interruptions of surface, and all these parts enter into the conformation of the basin.

For the most part it is smooth, and it is only in front that the surface seems to be roughened by some peculiar little granulations. Fig. 9 being a direct anterior view of the sternum of this Heron, the decussation of the coracoidal grooves is now best seen. The right one, (the left in the drawing) being the lower anteriorly, and running out over the top of the manubrium, while the left one, being the higher, crossing it in front.

So far as I have examined, this is the method of decussation in each instance, i. e., the right hand groove being the one that passes over the superior manubrial surface.

It is just possible that this crossing of the coracoids may have arisen in the habit of the ancestors of the present Herons, of passing constantly through very narrow places, as dense cane-brakes, or such other growths of analogous character, where they probably resorted

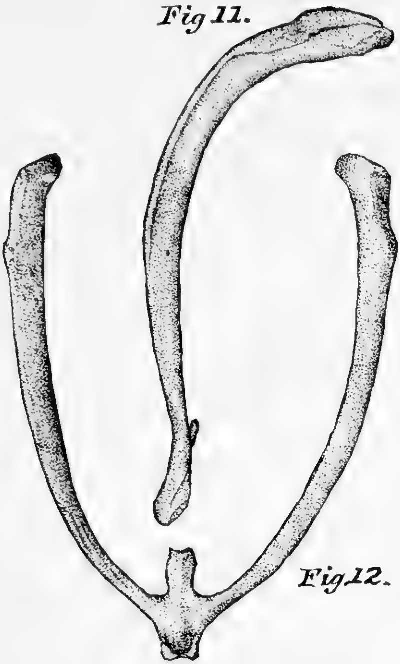


FIG. 11. Left lateral view of the furcula of *Ardea herodias.*

FIG. 12. The same bone from in front. Natural size, and from the same skeleton as shown in figures 8, 9, and 10 and others.

and spent the major part of their time. There would undoubtedly be an effort made many times a day to compress the body and diminish its general bulk in a transverse direction, in such situations. Moreover, the coracoids (if arranged as in most birds) would constitute the principal obstruction to such compression ; and it certainly lessens the width of the bird's body to have them crossed as they are in the Herons. If we commence sufficiently early in the life of the individual, bones and the normal position of bones may be altered

very materially by gradual pressure, differently applied ; then, why not, we ask, during the lapse of time, may not this result have been brought about in this way? It is hard to say, for even if it has been, then what are we to say about its being absent in some of the *Rallidæ*, and present again in such forms as *Polyborus cheriway* and several other Accipitres? I rarely see in any of the old-fashioned engravings, representing with the appropriate surroundings below, the noble falcon striking his prey, the doomed Heron, in mid-air, that this peculiar and unique condition of the coracoids, present in both the Hawk and his quarry, does not come into my mind. Both are desmognathous birds, yet it would hardly seem possible related through any such character as this, arisen however it may. Still we are beginning to catch glimpses of the affinities of the Herodiones, and morphology has much yet to bring to light in the premises. Fig. 9 shows these decussations of the coracoids very well, and the difference in width of the hinder and anterior parts of the bone, is well shown by the relative positions of the xiphoidal and costal processes ; the thickness of the front part of the carina now becomes evident, seen from this point of view.

The coracoids and scapulæ which I have taken the opportunity to show above will be treated of under the head of the pectoral arch. At the lower and inner angles of the coracoids, the dotted line indicates the amount of decussation of these bones when *in situ* in their grooves on the sternum. In *A. candidissima* the sternum differs from that bone in *Ardea herodias*, as I have described it above, in only the most insignificant minor details ; indeed, in all essential particulars, it is the veriest miniature of the latter bone.

With *Nycticorax*, although the principal features of a Heron's sternum are still there, yet a comparison of Figs. 8 and 32 will show that the bone has departed somewhat from the type form as seen in *Ardea*. The keel is comparatively much deeper in front and slopes up far more rapidly behind ; the manubrium bears a laterally compressed plate on its anterior extremity, which is as long as the part which corresponds to the triangular portion in *Ardea*.

Finally, the main pneumatic foramen, over the keel anteriorly, is very much larger. This may contract more, however, in specimens other than the one I have in hand, and in any event is a character of very trivial importance.

Of the Pectoral Arch.—Comparatively speaking the coracoid of

the Great Blue Heron, is a large bone. Its sternal extremity is much spread out and quite thin and plate-like. Articular surfaces occur on both aspects of this end of the bone, for the fellow of the opposite side and the sternum. One would think, and naturally, that these extremities of the coracoid would be quite unlike, from the fact that they cross each other in articulation, and are fitted in differently directed grooves on the sternum. Such, however, is not the case, for with the

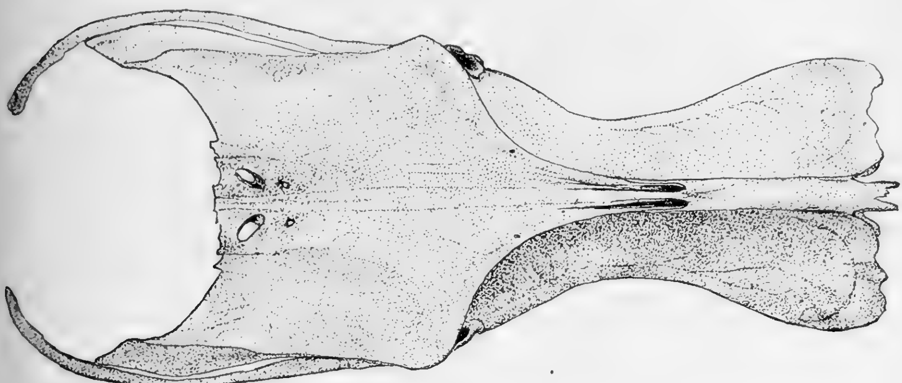


FIG. 13. Dorsal view of the pelvis of *Ardea herodias*. Natural size, and drawn by the author, as in the case of all the other figures, from the skeleton of the same specimen.

sole d fference of a slight asymmetry of the articular facets, these bones are no more unlike than we find them in the majority of birds.

The shaft of a coracoid is slender and somewhat laterally compressed, a compression that is extended to the head of the bone, where it becomes decidedly marked. The summit of the bone being capped with a tuberous crown which curls over mesiad, and extends backwards to merge into the glenoid cavity. This latter is ample and fully two-thirds of the surface is afforded by the coracoid. The scapula process with the line of its articular surface at right angles to the long axes of both bones, is no larger than is just necessary to accommodate the head of the scapula.

It never meets the furcula in any of the Herons that I have seen, and in all of these birds the bones of the pectoral arch are completely non-pneumatic.

The coracoid of *A. candidissima* differs in no particular from the bone I have just described for *Ardea herodias;* while though *Nycti-*

corax also agrees in this respect with these birds in the main, it differs in having the inner angle of the expanded sternal end of the *right* coracoid truncate, instead of being drawn out into a point as the fellow of the opposite side is. This is due to the fact that the groove on the sternum has that shape in the Yellow-Crowned Night Heron.

The *scapula* among the *Ardeinæ*, generally, is a long narrow bone, with but a slight curvature from head to distal extremity. This latter is simply rounded off in *A. herodias* and in the Snowy Heron, but inclined to be slightly truncate in *Nycticorax*. In the Great Blue Heron the head of the scapula is compressed from above, downwards, and much expanded in a transverse direction. Mesially it curls up a little to preserve the contour of the "tendinal canal," while on the opposite

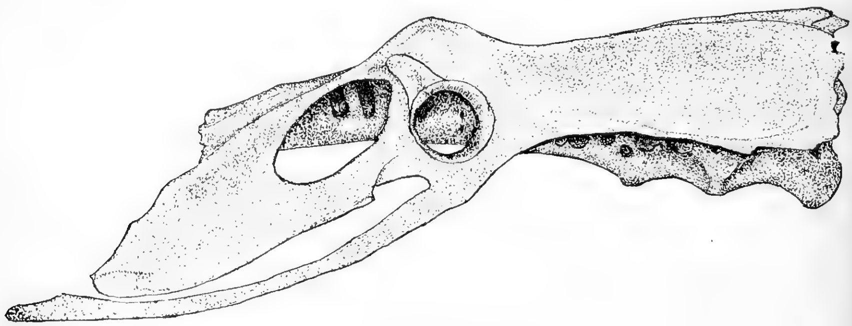


FIG. 14. Right lateral view of the pelvis of *Ardea herodias*. Natural size from the specimen.

side, it supports an oblique, elliptical articular facet, constituting one-third of the glenoid cavity.

Among the Herons the furcula, or the united clavicles, is a very interesting bone in one or two particulars.

In figures 11 and 12 I present two views of this part of the pectoral arch of *A. herodias*, taken from a specimen in my own collection, it being the same individual from which all the drawings were made which illustrate this species. I would do this, even if a hundred skeletons of the same species were at my command, as it is better in many respects. One of the chief reasons is that each skeleton, even among birds, has its own individuality, and ought to furnish all the figures if possible in any type monographed. The head of the *clavicle* in this Heron is tuberous, rather thickened, and evenly rounded off at its end. When articulated with the other bones of the arch, its superior border,

quite close to this extremity, rests against the under side of the projecting summit of the mesial aspect of the coracoid. The rounded end of the furcula, from this point, reaches back a sufficient distance to barely escape touching the mesial and up-curled side of the scapular head, that to all intents closes the tendinal canal by bony walls; its complete closure is really effected by the short ligament that holds these two bones *in situ* at this, their nearest point of approach. In some birds, as for instance certain diurnal Raptores, the canal is closed by the head of the furcula reaching the tip of the clavicular process of the coracoid. From the head of the bone to the hypocleidium a gradual reduction in size takes place, while the lateral compression is sustained throughout, at any rate within a short distance from the latter part.

Now the hypocleidium of the clavicles in *Ardea herodias*, as in other Herons, consists of both an inferior and a superior process (Figs. 11 and 12), both being in the same line. In our present subject the upper one is the larger of the two, while their common surface anteriorly is smooth and flat. Behind, it is rounded and marked by a longitudinal raised line. This latter feature in *Nycticorax* is raised to the rank of a well-developed crest, and the lower process in this bird, equals the upper in length, and as a whole is comparatively slenderer (Fig. 33).

Figure 34 gives a three-quartering view of the furcula of my specimen of *A. candidissima*. It will be observed that it differs in no important particular from *Ardea*, though the anterior surface of the lower process of the hypocleidium is longitudinally grooved, a feature which, by the way, I neglected to say, is faintly indicated in the latter Heron.

A glance at any of the figures representing this bone in the *Ardeinæ*, is sufficient to satisfy one that it is a very different affair from the corresponding part of the pectoral arch in such forms as *Sula*, *Phalacrocorax*, or *Pelecanus*. In these latter types the united clavicles arch backwards to meet the carinal angle of the sternum, here to articulate with it, or even as in *Tachypetes* and very old Cormorants to anchylose with it. The lower part of the furcula in Herons, is, on the other hand, turned forwards from the sternum, assuming a curve not often seen among birds.

Anatomists have termed the clavicular head in birds, the epicleidium, and this end of the bone, according to Professor Parker, ossifies

as a separate piece in some forms, notably the Passerine birds, and may be compared with the pro-coracoid of reptiles. Not having a young, or rather a sufficiently young enough Heron, at hand, I am unable to investigate the pectoral arch with the view of ascertaining how the development proceeds in the case of the forms under consideration.

Professor Owen, in calling attention to the relation between the hypocleidium of the clavicles and the carinal angle of the sternum, in other birds says: "The process itself reaches the sternum and is anchylosed therewith in the Pelicans, Cormorants, Grebes, Petrels, Frigate-bird, and Tropic-bird, also in the Gigantic Crane, and the Storks in general." I am compelled to take this statement with a little caution—as it does not always anchylose in the Cormorants, fails to do so in a number of the *Podicipididæ*, as in Clark's Grebe; and, so far as I am aware, rarely in the *Procellariidæ*; I have one or two exceptions before me; the least tendency to form such a union being seen in the Grey Fork-Tailed Petrel, (*Oceanodroma furcata*).

In all of these forms, however, the hypocleidium is in more or less intimate relation with the anterior border of the keel of the sternum. I have examples where the closeness of the contact is very intimate and requires special investigation to determine whether true anchylosis really exists or not. This is so even in *Oceanodroma* and *Colymbus* sometimes. I have several skeletons of the former before me, but I have figured one where it was the least so. No doubt these facts accompanied by the lack of good material led Professor Owen to make the above statement. It holds good for our United States *Gruidæ*, as *Grus canadensis*, and *G. americanus*, but not for *Aramus*.

Of the Pelvis and Coccygeal Vertebræ.—Many years ago I made a number of anatomical drawings for Professor Coues, these now illustrate his admirable "Key to North American Birds," 2nd Edition. Among these drawings I figured the under view of the pelvis of *A. herodias*, the bone now to be described. It is figure 60, in the work cited and as the present memoir contains two other views of this pelvis (Figs. 13 and 14) I have intentionally drawn them from the same specimen, which I was so fortunate as to still have by me.

The twenty-fourth vertebra of the spinal column of this heron is the anterior one of the series that becomes incorporated by complete anchylosis with those neighboring bones which go to form the pel-

vis. Indeed, so far as I have been able to examine, it is this vertebra throughout the *Ardeinæ* that holds this place. (See Fig. 14 *bis.*)

This *twenty-fourth vertebra* possesses a pair of free ribs which have already been described above; its neural spine is continuous with the common median crest of the others behind; and its broad diapophyses meet the under side of the ilia, on either side, to anchyloes with them. As in the remainder of the pelvic series of vertebræ, this bone is highly pneumatic, the foramina entering the bones much in the same manner as we found them doing in the dorsal region.

The next four vertebræ behind the twenty-fourth, or the twenty-fifth, sixth, seventh and eighth, throw up apophysial abutments against the iliac walls, to completely fuse with them.

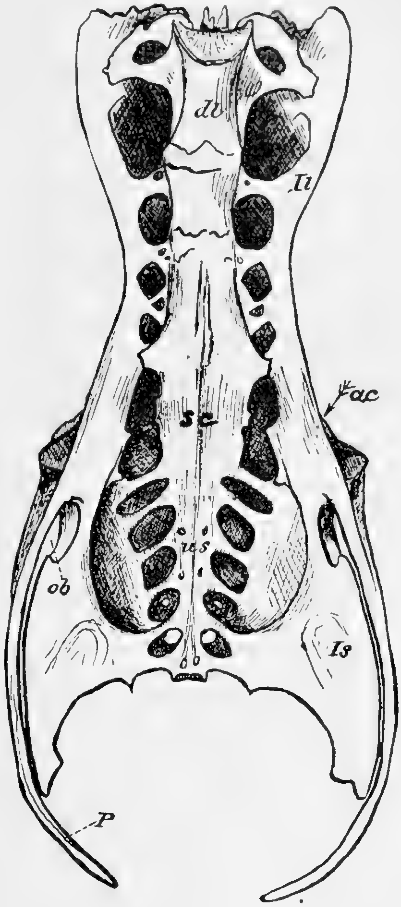
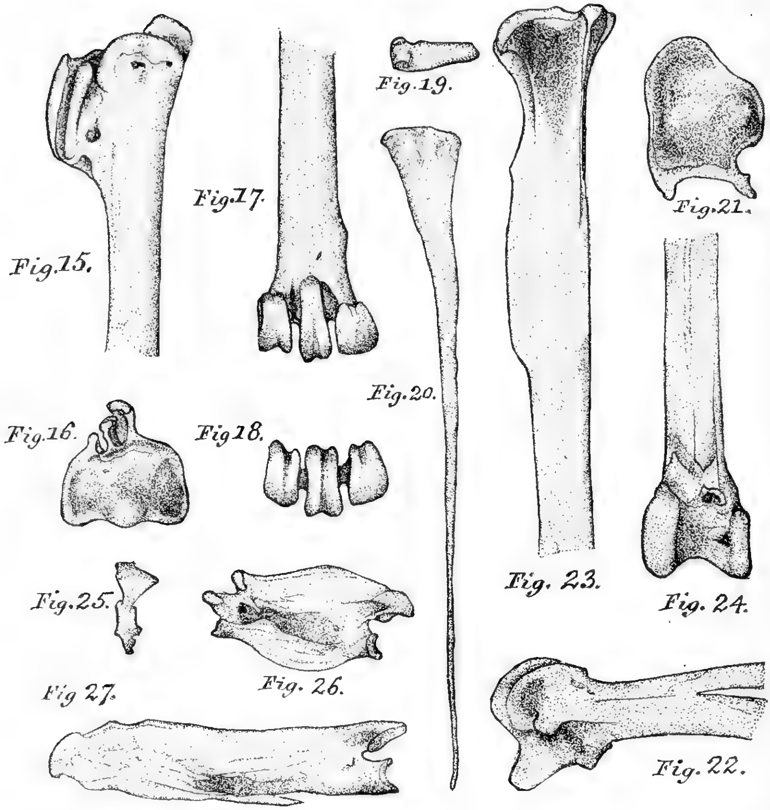


FIG. 14 *bis.* The ventral aspect of the pelvis of *Ardea herodias.* By the author, and natural size from the specimen. *Il*, ilium; *Is*, ischium; *P*, post-pubic style; *ob*, obturator foramen; *ac*, external aperture of acetabulum (indicated by arrow entering it). *dl*, dorso-lumbar vertebræ; *sc*, sacral vertebræ; *us*, uro-sacral vertebræ (probably six of them).

After we pass the twenty-eighth we suddenly meet the pelvic basin proper which is here deep and ample; the apophyses of the three next succeeding vertebræ, or the twenty-ninth, thirtieth, and thirty-first are thrown so directly upwards against the pelvic bones, that they can not be seen on direct ventral aspect. This is the region of the greatest enlargement of the neural canal, and also the bones through which



Various bones from the neck and the right upper and lower extremities of *Ardea herodias*. All from the same specimen, and natural size.

FIG. 15. Proximal extremity, right lateral view of the tarso-metatarsus.

FIG. 16. Same bone from above.

FIG. 17. Same bone, anterior aspect of distal extremity.

FIG. 18. Same extremity seen from below.

FIG. 19. Proximal end of fibula seen from above.

FIG. 20. Outer aspect of fibula.

FIG. 21. Proximal end of tibia, viewed from above.

FIG. 22. Proximal extremity of carpo-metacarpus, inner view.

FIG. 23. Anterior aspect, proximal third of tibia.

FIG. 24. The distal extremity of the same bone, anterior view.

FIG. 25. Left lateral aspect of atlas.

FIG. 26. Same view of the axis.

FIG. 27. Same view of the sixth cervical vertebra.

it passes are here more massive in order to contain that part of the cord from which the sacral plexus emanates. The foramina from which they issue, on either side, are double, being placed one above another. This obtains also in at least four of the vertebræ beyond these and one other behind, making eight in all whose sides are pierced by these double foramina.

Apophysial abutments are again thrown out to anchylosé with the pelvic bones above them, by the thirty-second to the thirty-seventh vertebræ inclusive. The longest pair of these come from the thirty-second vertebra, and thereafter grow gradually shorter as we proceed backwards.

The "brim of the pelvic basin" is continuous with the processes of the thirty-sixth vertebra posteriorly, while anteriorly it merges with the posterior border of the transverse processes of the twenty-eighth. This boundary has a rounded and well-defined border in the Great Blue Heron, and is more or less determinable in the majority of birds. When viewed from above, this bone presents a strikingly smooth and unbroken superficies—it is scarcely marked by either crests or ridges, and in my specimen only two pairs of inter-apophysial foramina are seen, these being between the last two vertebræ.

Anteriorly, in the median line, the neural spine of the twenty-fourth vertebra is observed to project as a tuberous and notched process.

For some little distance back of this, the ilia meet on either side of this common neural crest sealing over the ilio-neural grooves and making one rounded summit for this part of the bone.

The anterior margins of the ilia are notched and scalloped, and bordered by a somewhat deep and slightly raised emargination. Where these bones are broadest in front, the lateral edges are quite sharp, but as the pelvis contracts in width as we near the acetabula they become rounded and smooth. The iliac surface, on either side, thus bounded, is at first directed upwards and outwards, but as it approaches either acetabulum, this surface gradually comes to look almost directly outwards. Ilio-neural grooves exist between the anterior forks of the gluteal ridges for some little distance, before these latter and well defined crests are lost anteriorly (Fig. 13).

Few traces or markings are left upon the inner margins of the postacetabular surfaces to define the boundaries which originally existed between the vertebræ and the iliac bones; they are best seen behind. For the most part though, the pelvic roof has become in

the adult one unbroken surface—a very smooth and firmly-ossified tract.

The outer angles of the gluteal ridges are rounded and project immediately over the antitrochanter on either side, from which point each ridge runs almost directly backwards to the hinder margin of the bone. This latter, as a whole, is concave towards the posterior aspect, and from its outer angles the curved and inturned pubic bones may be seen pointing towards each other, their tips some two centimeters apart.

Only a limited part of the surface of either ischium can be discerned from this superior view, as these bones behind are nearly at right angles with the overhanging ilia.

Among all the *Ardeinæ* that I have had the opportunity to examine, the post-acetabular surface is about equal in extent with the pre-acetabular area. In the former the general surface is convex, while in the latter it is concave; the boundary between them I place, in common with Owen, at the line of the gluteal ridge. The post-acetabular surface slopes downwards from a line joining the outer gluteal angles; the amount of which declination can best be appreciated by a glance at my figure of the side view of this pelvic bone (Fig. 14).

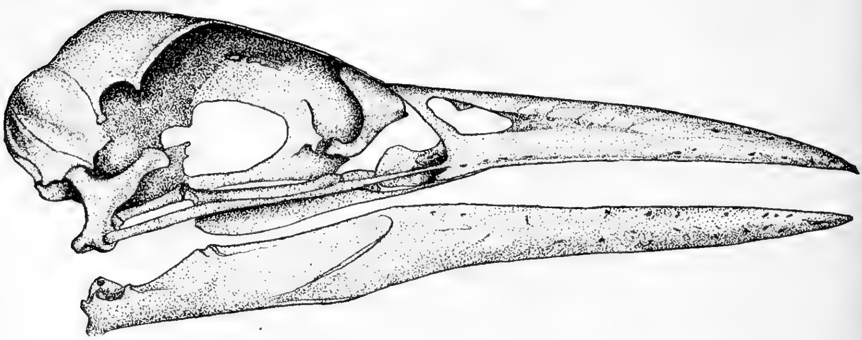


FIG. 28. Right lateral view of the skull of *Nycticorax violaceus*, "bird of the year" (July). Natural size from a Louisiana specimen collected by the author.

Upon lateral aspect the centra of the leading vertebræ may be seen below the eaves of the iliac roof, and some idea gained of the massiveness of the osseous column upon which the pelvis of this Heron is built.

The acetabulum is large and circular, with its floor more than usually deficient, the inner ring nearly equalling in size the outer, while the

anti-trochanterian articular surface is carried by them both as it passes inwards. Externally this facet looks downwards and only slightly outwards.

The *ischiadic foramen* is large and subelliptical, its major axis being parallel to the line of the outer border of the post-acetabular surface, which here arches over it. Posterior to this foramen, the broad part of the ischium is roughly quadrilateral in outline, and for the most part smooth and slightly concave. It is nearly at right angles with the iliac surface above it. In this Heron the *obturator foramen* is far from complete or deserving the name of a foramen. Nearly its entire posterior arc is deficient, and the opening thus created leads into the obturator space, which latter is found beneath the entire lower margin of the ischium, being broadest in front and gradually tapering off behind (Fig. 14).

Ardea herodias has a blade-like pubis of nearly an equal width throughout, though it is rather wider behind after it passes the ischium and curves mesiad towards its fellow. Just before it does this it is slightly overlapped by the lower and posterior angle of that bone, or else meets it in a single point of tangency, or, as in the figure, does not quite come in contact with it. Quite a large pneumatic foramen is found beneath the projection of each ilium immediately behind the anti-trochanter.

The vertebral column may be seen in part through the apertures afforded by the acetabulum and ischiadic foramen upon this lateral view. Except at its sacral dilatation, the neural canal as it passes through the vertebræ of the pelvis is small; it will be remembered that we found it quite so in the dorsal region also.

My specimen of the pelvis, taken from the skeleton of *Ardea candidisima* (a bird of the year) although thoroughly herodine in all of its salient points, it still differs in some of its minor details from the same bone in *Ardea herodias*. A careful count shows that an equal number of vertebræ are anchylosed together to form the central mass for the support of the pelvic arch—fourteen in each case, *i. e.*, the twenty-fourth to the thirty-seventh inclusive. This obtains also in the Yellow-crowned Night Heron, and in both these birds the brim of the pelvic basin departs from and arrives at identically the same segments as described for *Ardea*.

In *A. candidissima*, the ilia do not overreach the twenty-fourth vertebra although otherwise these bones are comparatively longer and nar-

rower than in *A. herodias*. A greater number of inter-apophysial foramina pierce in double rows the middle area in this Heron; these, however, may be obliterated in older birds.

Nycticorax also possesses a true heron's pelvis, and so far as this bone is concerned the differences between it and the pelvis of *Ardea herodias* are of so trivial a nature as scarcely to be noticed on first sight. The principal ones are these: in *Nycticorax* the gluteal ridges and outer angles are not nearly so prominent; a greater number of inter-apophysial foramina exists upon the dorsal aspect; the last vertebra, the thirty-eighth of the spinal column, anchyloses with the sacrum, although it projects entirely beyond the pelvis, this one corresponding to the first of the free coccygeal series in *A. herodias;* the hinder ends of the ischia are cut squarely across and do not apparently project beyond the ilia; and finally, the obturator foramen is more nearly entire.

I find seven freely articulated *coccygeal vertebræ* in *Ardea herodias* and a pygostyle. *A. candidissima* shows but six, and the pygostyle, but it may be possible that one of these vertebræ has by some accident been lost in my specimen. We saw above in *Nycticorax*, how, in that Heron the first one of the series anchylosed with the pelvis, both by its centrum and by the antero-external angles of its diapophyses.

These seven vertebræ in the Great Blue Heron are non-pneumatic, and all but the last three entirely devoid of hypopophyses, and it may be absent on the first of these.

The first five have broad flaring diapophyses, which are entirely aborted in the last segment, and only barely apparent in the one that precedes it.

In caliber, the neural canal is larger than we would be led to expect from the size of that tube as it appears in the last uro-sacral vertebra of the pelvis.

The neural spines are bifid and subcompressed, while the form of the anterior and posterior articular surfaces of the centra are transverse and flattened ellipses.

Herons being birds with short, weak tails, composed of but a few feathers, we naturally find a correspondingly feebly-developed pygostyle.

In *Ardea* this bone has projecting from its lower anterior angle a process nearly as long as half the bone itself. It represents the hypopophysis of the leading vertebra that was absorbed to form, with prob-

ably several others, this compound bone. Very faint traces of another such a process may be seen marking its side farther back, and above it the barest hint of the centrum of the corresponding vertebra. For the rest, the pygostyle is an irregular, quadrilateral plate, less than a centimeter deep, and a little more than one long, measured on its longest diameter. It has a round, thickened posterior margin, and its upper and lower edges are sharpened. A pit marks the flat anterior

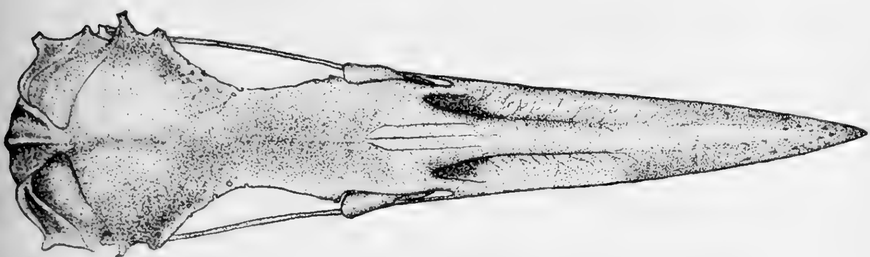


FIG. 29. Superior view of the skull of *Nycticorax violaceus*, juv. Natural size, and the same specimen as shown in Fig. 30. Drawn by the author.

surface, which continues for a short distance into the substance of the bone, the neural canal of the caudal vertebræ. Other Herons have the pygostyle rather differently fashioned from this, though in each instance the leading features are present.

FIG. 30. Superior view of the mandible of *Nycticorax violaceus*. Drawn by the author, natural size from the specimen. From the same skeleton as Figs. 28 and 29.

Of the Appendicular Skeleton. The Pectoral Limb: Ardea herodias has a highly pneumatic *humerus*, which in the well prepared skeleton is a snowy-white, and for its size a wonderfully light bone. The pneumatic aperture is of small dimensions, it being a sub-elliptical opening at the usual site for this orifice in birds. It differs some-

what, however, in lying in the same plane with the general humeral surface, below the ulnar crest, and not being situated at the base of a pneumatic fossa, in which several openings are usually seen leading to the hollow shaft of the bone. From radial to ulnar side the proximal enlargement of the humerus is not nearly as great as we find it in many others of the Class. At its summit there is an oval, convex facet for the glenoid cavity. This is separated from the ulnar crest by a deep intervening valley, which appears all the deeper from the great prominence attained by the former.

The radial crest is, on the other hand, quite low, and not unusually developed. It extends down the shaft only to the point where the latter commences to assume the cylindrical form. On the palmar aspect of the proximal end of the humerus we have a well-defined trench extending across the bone, just behind the ulnar crest and glenoid head. Another, fainter one, though pretty well marked in the direction of the shaft, marks out the boundaries of a convex, sub-oval and flattened space, on the lowermost side of the palmar aspect of the proximal end of the bone, which is present in some form or another in this place on the humerus, in a number of the Class.

The shaft for the greater share of its length is cylindrical and smooth; the sigmoid curves it presents in the majority of birds are here well marked. The distal extremity is dilated in the same plane nearly with the proximal end, to give space for the guidance of muscular tendons on the anconal side, which there pass over grooves marking the bone, as well as affording the necessary breadth to support the ulnar and radial tubercles on the palmar side. Above the latter is seen a long, subelliptical depression, running obliquely up from this dilated portion to a point where the shaft begins to assume the cylindrical form.

The *radius* is a non-pneumatic bone, and like all bones of this character, in the ordinarily prepared skeleton becomes yellow, dark and greasy, owing to the oily constituents of the contents of the shaft gradually oozing through its walls.

This bone, in common with its companion in the anti-brachium, is considerably longer than the humerus. From proximal to distal extremity its shaft is much bowed in the palmar direction.

The proximal end is comparatively little enlarged; it presents the usual subelliptical facet for the humeral tubercle of the bone of the brachium. On its end, and shaft-wise, the ulnar facet is presented for our examination.

For its length and the general size of the bird, the shaft of the radius is quite slender. In form it is subtrihedral with the salient angles rounded off.

Usually the *ulna* is quite straight, or has only a slight degree of curvature, but in the present subject it is bowed nearly as much as the radius and very much in the same way. It is hardly necessary to say that in common with the radius and the skeleton of the pinion, that it is likewise found to be a perfectly non-pneumatic bone. Its shaft is about two and a half times the size of the radius, but instead of being subtrihedral in form, it is nearly cylindrical.

Two rows of quill-knobs are distinctly seen upon its length, one on the ulnar and one on the palmar aspect; the former being the more strongly marked.

The shaft decreases in size gradually from the proximal to the distal end, very imperceptibly from the middle of the bone on. A nutrient foramen is seen on the anconal aspect at the proximal part of the middle third.

The carpal end shows the usual trochlear surface, and the facets for the *radiale* and *ulnare* of the wrist. Proximally, the enlargement is much greater in order to afford sufficient breadth, to make room for the extensive excavations that are found at this end, to articulate with the radius and bone of the brachium. The olecranon is but feebly developed and tuberous. Measurements taken from these bones in an adult specimen of *Ardea herodias*, shows the humerus to be 19 cm. long; the radius 22 and the ulna 23.1, which goes to show that the brachium and anti-brachium are proportionately balanced as to their respective lengths. Both of the carpal elements are present, the *radiale* and the *ulnare*. They are of good size, articulate as in most birds, and are fashioned after the most usual pattern assumed by these bonelets.

The *carpo-metacarpus* makes up in length in this heron what it otherwise lacks in breadth. It measures 10.3 cm. long, while across the widest part above it is but 1.8 cm.; this latter measurement being from superior tip of pollex metacarpal directly across the bone to outer edge of trochlear surface.

The first metacarpal, anchylosed as usual at the upper and anterior aspect of the bone, is very short, slightly bent anconad, and directed rather upwards as a tuberous process. Beneath, it supports the extensive convex articular facet for pollex digit, which latter is long and

somewhat laterally compressed. It bears a diminutive facet at its distal extremity, and appears as though it might have had in life a claw there, which has been lost in my specimen. Nitzsch, who examined many groups of birds to investigate this among other points, places the Herodiones in the category of birds in which he discovered it to be present. So on the authority of this eminent anatomist I believe we may safely say that our subject will be found to possess such a claw.

For its entire length the main shaft of this bone is very straight, and such part of it as is free from contact with other bones above and below, is subtrihedral in form and devoid of particular character.

Showing a considerable transverse dilatation at its proximal extremity, the third metacarpal soon quits the shaft of the second to become much smaller and rounder, being parallel to it, until within a short distance of its lower end, where both are again connected by bone.

At the proximal extremity of this carpo-metacarpus, we find a broad trochlear surface, contributed in the usual manner by the *os magnum*, one of the free carpal bones in the wrist of subadult birds. As in the majority of cases all the sutural traces of this union, have with the growth of this heron become obliterated.

Upon the palmar aspect, just below the superior convex margin of this trochlear surface, at the head of the index metacarpal, we observe projecting forwards a small stumpy process.

The distal end of the carpo-metacarpus in the adult *Ardea herodias* is almost entirely occupied by the two articular facets for index and middle digits. A notch divides them. In the case of the first, the proximal phalanx is a long bone (3.8 cm.), with a posterior blade-like expansion. This latter is not very broad, being thick and unpierced by foramina, as we sometimes see it in the Gulls and other water birds. A long, pointed subtrihedral joint succeeds this one, which in turn seems to have a facet upon its distal extremity, either for a claw or another minute joint, such as we find among the Ducks and Geese, but in my specimen it is missing. The third metacarpal supports a digit composed of a single sub-compressed, narrow phalanx, nearly two centimeters long.

Taken in connection with what Nitzsch has given us upon the subject, I believe the formula for the manus of the Herodiones will be found to be pollex metacarpal, with a digit composed of two phalanges ;

index metacarpus, with a digit of three phalanges; and middle metacarpus with a single phalanx to its digit.

So far as the material goes that I have been able to examine, the pectoral extremity among the *Ardeinæ* offers no very striking differences. As a good illustration of the slight departure that is made from a common plan among these Herons, no better example could be offered than the series of bones shown in figures 35, 36 and 37, being the right humerus from *Ardea herodias*, *Nycticorax* and *A. candidissima*.

Of the Pelvic Extremity.—After the most careful examination of the material at hand, I find it is only in the femur of *Nycticorax* that pneumatic foramina exist. These are exceedingly minute, though they may be detected without the aid of a lens just over the border of the anti-trochanterian facet on the posterior aspect of the bone. In *A. herodias* and *A. candidissima* the *femur*, as well as all the other bones, composing the skeleton of this limb, are absolutely non-pneumatic.

Our Great Blue Heron has a femur fully as long as its pelvis omitting the free, posterior end of the pubis. Its head and neck make nearly a right angle with the shaft, the former being hemi-globular and much excavated for the ligamentum teres, while the latter is short and thick. At the summit of the bone the anti-trochanterian facet is broad and extensive. From before, backwards, its surface is convex; in the other direction, that is from the head to the trochanter, it is concave, becoming gradually wider as it approaches the latter.

The trochanterian ridge does not rise above this articular surface to any perceptible degree, but becomes rather prominent as it passes down the shaft for a short distance on its outer and anterior aspect.

On the outer and proximal end of the femur, the trochanter major is broad and nodular. The shaft below this point, to where it begins to expand for the condyles, is nearly straight and quite cylindrical. Its muscular lines are distinct and raised; on the posterior aspect, above the middle, the nutrient foramen is to be seen. It opens in a direction obliquely from above downwards.

Just above the anterior ridge of the external condyle, I find in all Herons, on the antero-external aspect, a prominent and elongated tubercle. It has to do with muscular attachment, and one of the muscular lines is deflected from its course to run into its upper end.

The condyles of this bone are strong and massive. The articular surface of the inner one is broad behind, and so far produced in this locality as to render the popliteal depression appear more than usually concave and excavated. Above each condyle behind is seen a well-marked tubercle, with pits on their outer sides for the insertion of lateral ligaments and muscles. The external condyle has the usual fibular groove, deeply cleft and carried down behind well nigh to its base; it is more prominent than its fellow, though not as broad. Between them, the inter-condyloid fossa is moderately deep, rather wide, and carried up on the anterior aspect of the shaft as a "rotular channel" of like dimensions, though not mounting as high as it does in some birds. Of these two condyles, the external one is rather the lower, the bone being held in the vertical position.

I fail to find a *patella* present in any of the *Ardeinæ*; in *Nycticorax* a thickening in the ligament takes place at the usual site of this sesamoid in other long-legged birds where it is found, but this ligamentous enlargement is entirely devoid of any osseous deposit.

The *tibia of Ardea herodias* as we might expect is a very long bone, and in every particular typical as found in Herons generally. Viewed directly from above, on its proximal end (Fig. 21) we observe that it

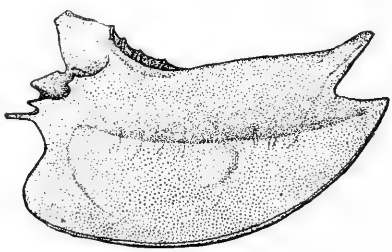


Fig. 31.

FIG. 31. Left lateral view of the sternum of *Ardea candidissima*. Adult specimen. Natural size, by the author.

has a roughly quadrilateral outline, its general surface sloping towards the fibular side.

The intercondyloid tubercle is prominent, and situated rather external to the center of this surface, while anteriorly it is bounded by a low cnemial crest.

Regarding the shaft from in front (Fig. 23), we notice that the pro- and ectocnemial ridges are but moderately developed, and very

soon subside into the shaft below. A wide valley is between them, and the inner one or procnemial ridge is vertical to the shaft and exactly divides the inner surface of it from the anterior.

All about the head of the tibia the articular summit projects over with its broadly rounded margins.

The "fibular ridge" extends down the tibial shaft on its outer side but a comparatively short distance. It begins above at a point opposite where the ectocnemial ridge merges into the shaft. Behind, a longitudinal concavity fairly defines its extent from the posterior surface of the tibia; in front, the anterior surface of this fibular ridge lies in the same plane with the anterior surface of the tibial shaft.

From proximal to distal end his shaft is as straight as any long bone that I am familiar with; it is only just before we arrive at the condyles below that we notice the slightest disposition in the world to bend backwards.

For its entire length behind, the surface is cylindrical; this is entered into by both the lateral aspects, while anteriorly it is flat, and only round at all for a limited part of the shaft about at the junction of middle and upper thirds. This flat anterior surface above looks directly forwards, and this is the case also above the tendinal bridge, but as we ascend the shaft from this latter point, it gradually turns towards the outer aspect, when finally it is limited by a raised line that descends on this side from the fibular ridge, and merges at last into that part of the shaft which is subcylindrical, at junction of middle and upper thirds.

At the distal extremity, the shaft enlarges but very slightly, and just sufficient to afford a base for the condyles, which here project in consequence well out in front of it, both before and behind, more particularly in the former direction (Fig. 24).

The "tendinal bridge," though present, is not nearly so well developed as in some other birds, and in my specimen of *Nycticorax* a "bird of the year," it is not united in the middle, it being simply represented by a triangular process on either side, with their bases in the margins of the excavation, and their apices opposite and nearly touching each other. A tubercle occurs above the outer condyle at a point where this bridge arises on that side. This is its lower origin, as it spans the tendinal groove rather obliquely.

The inter condyloid depression is wide, deepest in front, to become narrower and shallower behind, where it ceases as the shaft commences.

Viewed anteriorly, the outer condyle is the broader, extends higher on the shaft, but projects no further in front than the inner one. This latter, slightly encroaching on the intercondyloid space, is excavated by a well-defined subelliptical pit, which is better marked in the Night Herons, though present in the *Ardeinæ* generally.

Viewed from behind, these condyles of the tibia in *Ardea* mount to points about opposite each other on the shaft. There, however, the inner condyle is the broader, and rather more prominent above.

Upon lateral aspect these condyles are uniform in outline with the convex surfaces below; and from above, downwards, the outer is the deeper of the two.

In my memoir on the Osteology of the Gallinæ (in MSS.) I describe the method of ossification of the cnemial crest of the tibia in the young of *Centrocercus urophasianus* and give a figure showing this development, which, in brief, consists in a large osseous segment engrafted upon the bone, at the future site of the cnemial crest and upper halves of the pro- and ecto-cnemial ridges, all of which it forms, but leaves no trace of such a development in the adult fowl.

My only regret is that I have not at this moment the proper material to investigate whether or no a like method of development goes on in the young of the Herons.

As for the distal extremity of this bone, it also has received no little attention generally, but in particular the young of our present subject has been ably investigated at the hands of Professor Morse.

It was through his studies of the tibia and tarsus of immature individuals of various spcies of *Ardea* that this distinguished zöologist was principally enabled to demonstrate the presence of the intermedium in the Class birds. Professor Morse's researches have proven, I think, beyond doubt, that the "ascending process of the astralagus" of Huxley agrees with the "pretibial" of Wyman. Further, this segment ossifies from a separate center of ossification, and as such constitutes in the avian tarsus a third bone of the proximal row, which corresponds with the *intermedium* of the Reptilia as described by Gegenbaur. No one would suspect the presence of any such bone in the adult, in any of the *Ardeinæ*, it having been completely absorbed by the tibia, and every vestige of its original limits obliterated.

The *fibula* of the Great Blue Heron is a very much aborted bone, not only when it is compared with that bone as it is found in many

other birds, but when compared with the size of its own tibia (Figs. 19 and 20).

The upper surface of its distal end is devoted entirely to the facet for articulation with the condyle of the femur. Below this the bone is compressed from side to side, and produced from before, backwards. Then rapidly contracting it presents a roughened surface intended for ligamentous attachment to the fibular ridge of the tibia. Near this we see the tubercle for the insertion of the tendon of the biceps. The remaining length of the fibula becomes almost needle-like in its dimensions, and makes no osseous connection with the tibia whatever, passing but little below the upper third of its shaft, which when the bone is removed shows no evidence of its contact, more than the roughness of the fibular ridge.

Ardea candidissima has a fibula that agrees in all respects with the one I have described for the Great Blue Heron. In *Nycticorax* it differs in one important particular, and this is, that after passing its articulation with the fibular ridge of the tibia, its almost thread-like dimensions are carried well below the middle of the shaft of the leg-bone to unite with it by ossification, for at least a third part of its length.

Next in order we have to notice the *tarso-metatarsus*. The differences that this segment of the lower extremity exhibits among the various herons, seem to be scarcely worth the mention. So I expect a description of the bone as it is found in *Ardea herodias*, will answer with sufficient exactness for the group.

Different views of the tarso-metatarsus are shown in figures 15, 16, 17, and 18 all drawn from an adult specimen of the Great Blue Heron.

A very prominent tubercle occupies the anterior part of the proximal extremity. It stands between the two elliptical concavities intended, when articulated, for the condyles of the tibia. The margins surrounding the extremity are raised at the sides and sharpened. Posteriorly, we can also see from this view, the three processes composing the *hypotarsus*. Of these the innermost one projects the farthest backwards, as well as extending the greatest distance down the shaft. The outermost one of the three is the smallest, being just about half the size of the innermost one. The middle one falls between these two so far as its height is concerned, but it is as long as the innermost one (Figs. 17 and 18).

In order to support this great tendon-grooved hypotarsus, and broad articular surface, the shaft of the bone at this end is proportionately

enlarged. It grows gradually smaller, however, as we descend, being of the least calibre in the lower third, when it again enlarges transversely to support the trochleæ for the digits. The upper half of the bone is flat both posteriorly and at the lateral aspects. In front it is longitudinally excavated down the middle, beginning where it is the deepest, just below the inter-condyloid tubercle. As we gradually pass to its lower half the shaft becomes subelliptical on section, the major axis being transverse.

At the base of the excavation above, a few millimeters below the anterior crest of the summit, we find the shaft pierced by two foramina, placed side by side. The innermost and larger one of these passes rather obliquely through the bone to make its appearance, rather larger in size, just inside of the hypotarsus.

Considerably smaller, its companion pierces the tarso-martarsial shaft, still more obliquely downwards, to make its exit as a foramen of diminished calibre on the opposite side of the hypotarsus. The posterior opening of this latter one is seen in Fig. 15.

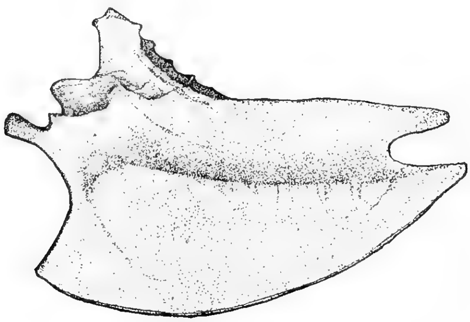


Fig. 32.

FIG. 32. Left lateral view of the sternum of *Nycticorax violaceus* (subadult). Natural size, by the author from the skeleton of the same individual that furnished Figs. 28–30.

Viewed from in front, the trochleæ present the following points for examination: the middle one extends the highest on the shaft, and projects beyond the others anteriorly. It is distinctly grooved down its middle, and descends the lowest. The inner one is the broadest and is perfectly smooth in front, being but slightly grooved behind, while the other two are decidedly so. Finally, the outer trochlea is

also smooth in front, and does not descend as low as either of the others. Between this one and the next the usual foramen pierces the bone, low down in the groove between them.

Fig. 33.

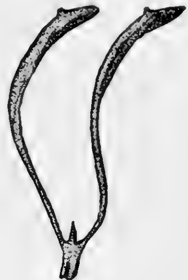


Fig. 34.

FIG. 33. Left three-quartering view of the furcula of *Nycticorax violaceus*. (Sub adult.)

FIG. 34. Same view of the *os furcula* of *Ardea candidissima*. Both natural size from the specimens.

It will be seen that these trochleæ are so placed as to be slightly convex forwards, and in a less degree concave behind, where they come up to nearly the same points on the shaft, the middle one being rather the lowest. Moreover, the mesial grooves that mark them are here carried up to their very terminations. This posterior aspect of the distal extremity also shows the foramen for the anterior tibial artery in full view. Above these trochleæ, and to the inner side, the circular facet for the first metatarsal is found.

These three long bones of the pelvic extremity of *Ardea herodias* have the following measurements in the adult: the femur, measured from the highest point on the trochanterian ridge to the lowest point on the outer condyle, is 10.5 cm. long, the tibia, 24.5 cm. and the tarso-metatarsus, 17.8 cm. long, measuring from the highest point on the intercondyloid tubercle to the lowest point on the middle trochlea. We may add here that the length of the fibula which is but 9 cm., being one and a half centimeters shorter than the femur, and fifteen and a half shorter than the tibia.

The first metatarsal is a free bone, with a peg-like shaft and exlarged lower extremity. It is enlarged at its proximal end where it sup-

ports a circular facet on its lateral aspect, to articulate in life with the surface described above on the tarso-metatarsus. Thus it is that this bone is so mobile, and can be thrown backwards to a considerable distance. Below, it bears a trochlea for the rear phalanx of hallux, which reaches high on its shaft on the digital side of the bone, being faintly grooved on the other. The entire length of this segment is 1.7 centimeters.

At the proximal end of the first phalanx of hallux, the trochlear surface is far more extensive than its opposed surface on the first metatarsal, being fully half as broad again. The shaft is rather slender, gently curved throughout, convex upwards, and subcircular on section. Its distal trochlear surface is principally on the under side of the bone. It is narrow transversely, and shows a shallow median longitudinal groove. The sides of this extremity are marked by pits for ligamentous attachment. It measures in extreme length 4.6 centimeters, being the longest phalanx of the pes.

Its osseous claw is rather more than moderately curved, and exhibits the usual trochlear surface and the tubercle for tendinal insertion. The distance from this latter point to the apex measures 1.6 centimeters. Both the convex surface above and the concave surface beneath is uniformly rounded off, while the bone is laterally compressed. A groove distinctly marks it on either side, but is not quite carried to the apex.

Second digit has three phalanges including the ungual one; the proximal phalanx has all the characters as given for first joint of hallux; it, however, is distinguished by a prominent tubercle to the inner side of the articular surface for the trochlea of tarso-metatarsus. The bone is rather stouter and somewhat shorter. The second joint is a still shorter and a slighter bone; its proximal trochlea is concave from above, downwards, very slightly convex in the opposite direction. The shafts of these bones are not curved to the degree found in the first joint of hallux, and the proximal ones are always the straightest. Agreeing even in minor details, the ungual phalanx of this second digit is smaller than the one found in the first toe, but shows about the same amount of curvature. These three joints measure from proximal to distal one, respectively 4.4, 3.1 and 1.1 centimeters; the ungual joint being measured as I measured the bony claw of the first digit.

The four joints of the middle or third digit have the general characters as given for these phalanges above. Measuring them in the

same way and in the same order, I find the proximal phalanx to be 4 centimeters long; the next 3.9, the next 2.1; and the ungual one, measured as before, 1.1 centimeters long.

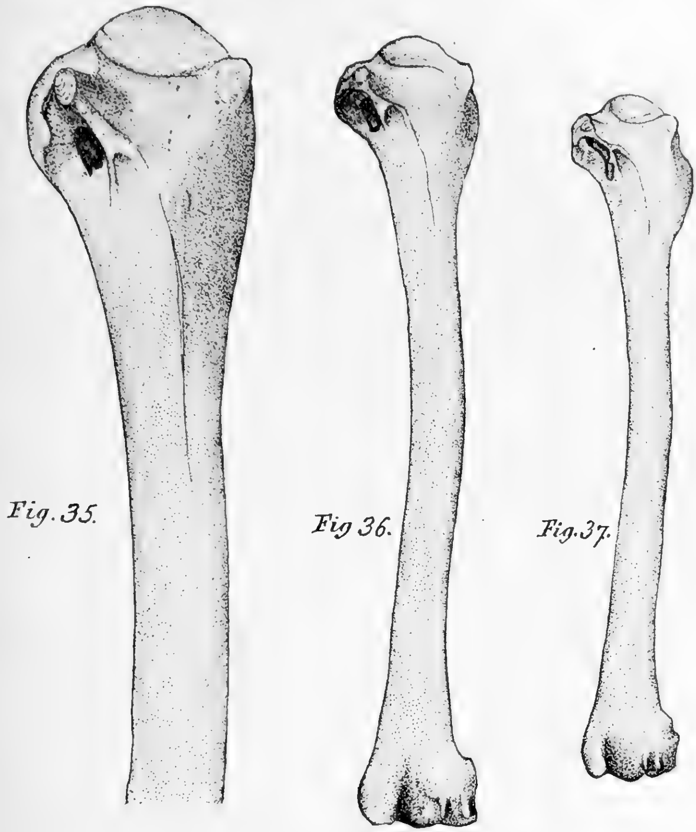


FIG. 35. Anconal aspect, proximal extremity of the right humerus of *Ardea herodias*.

FIG. 36. Right humerus of *Nycticorax violaceus* (subadult); anconal aspect.

FIG. 37. Right humerus of *Ardea candidissima*; anconal aspect. All three bones natural size, and drawn from the specimens by the author.

Outer digit has five joints agreeing in the main with the other phalanges of the toes of this Heron's foot. They measure, in the order as given above, from proximal to last one, 2.9, 2.8, 1.7, and 1 centimeter long. Of course the actual length of these ungual measurements will be found to be rather more than those I have given, but it must

be remembered that I only present the length of the chord from the tubercle on the inner side of the proximal extremity to the apex of the joint.

Herons possess no special ossifications other than those I have mentioned, that I am aware of, in their skeletons.

They have, in addition to their general structure, three peculiar external characters in common with a no less remotely related group of birds than the *Caprimulgi.* Coues, in characterizing the Night-jars, says: "Besides the semi-palmation of the feet, there is another curious analogy to wading birds; for the young are downy at birth, as in *Præcoses*, instead of naked, as is the rule among *Altrices.*" (Key, 2d Ed., p. 448.) This author does not mention there however, a third character, it no doubt having slipped his mind at the time the above-quoted paragraph was penned. It is, that both the *Caprimulgi* and the *Ardeinæ* possess in common that very rare character—the *true* pectination of the inner margin of the claw to the middle toe of pes. This character is also seen in *Fregata*, a form far removed, osteologically, from the true Herons.

Synoptical and Comparative Review of the chief Osteological Characters of certain species of North American Ardeinæ.

1. In all the North American *Ardeinæ* the superior osseous mandible is of a subpyramidal form, with its base merging into the skull and its apex at the tip of the beak. It has three sides, the angle of the culmen being rounded off, the other two angles being cultrate. In length it is a little less than twice as long as the remainder of the skull, being notably *shorter* in some of the Night Herons than in the genus *Ardea.*

2. Osseous internasal septum very incomplete or altogether absent.

3. All are acutely holorhinal birds.

4. All have (in the dried skull) a moderate movement at the cranio-facial hinge; best marked in the Night Herons.

5. Ethmoid much swelled; broad and spreading under the frontal region; and truncated transversely in front, just posterior to the line of the cranio-facial hinge.

6. Pars plana very feebly developed both in *Ardea* and the Night Herons. It fails to meet the inferior and backward extending process of the lacrymal on the same side.

7. Very large, spongy maxillo-palatines, lofty and parallel to each other in the rhinal chamber, attached to nasals and premaxillary by

bony union. In some specimens they may come in contact with each other mesially, or they may have the anterior part of the vomer resting upon their hinder ends. In *Ardea* they are nearly all of a bony spongy tissue (cancellous). In *Nycticorax* they are generally overlaid with compact osseous tissue, and cancellous internally.

8. Vomer is a single plate; deep, sharp and produced in front; doubly carinate above, with the two carinations curled over outwardly so as to create a longitudinal trough upon that aspect; united with palatines behind and free anteriorly. Inferiorly it shows its original bifurcated form, with greater or less distinctness.

9. Palatines are doubly carinated longitudinally; inner keels being in close contact on the halves towards the rostrum (a contact that may result in anchylosis in very old individuals). Anteriorly they are horizontally flattened and merge with the premaxillary and surrounding bones. The posterior angles of their outer carinations bluntly pointed and not prominently produced. Pterygoidal heads extensively in contact, and above unite to form a groove for the rostrum.

10. A post-maxillary present (?).

11. Basi-pterygoid processes absent (negative character).

12. Quadrates very large; the foot of either having four facets for the mandibular articulation.

13. A lacrymal bone is very large and articulates with both nasal and frontal of its own side. In *Ardea* its infero-produced portion is roughly parallel to the maxillary below it. In *Nycticorax* it makes a wide angle with the same bone, the anterior end of its infero-produced portion being much elevated.

14. Interorbital septum shows one large vacuity which includes the optic and other small nerve foramina near it. In *Ardea* the foramen for first pair of nerves, generally very large. In *Nycticorax n. nævius* these are smaller. In *Nycticorax violaceus* (adult) they are *very small* indeed, and just allow the passage of the nerve.

15. Three jutting processes on lateral aspect of cranium.

16. In *Ardea* and *N. n. nævius* the crotaphyte fossæ are separated by a considerable longitudinal median line. In *N. violaceus* it is by a tract of some width.

17. Foramen ovale, lateral.

18. In *Ardea* mandibular angle *obliquely* truncated. In *Nycticorax* mandibular angle *vertically* truncated (least obliquely in *A. virescens*,

least vertically in *N. n. nævius*). As a negative character we find the mandible in all *Ardeinæ* without a ramal vacuity.

19. There are 44 vertebræ and a pygostyle in the vertebral column of the *Ardeinæ*. In all, the dorsal series are free; in all, the twenty-fourth to the thirty-seventh inclusive are anchylosed with the pelvic bones; in all there are seven caudals. In *Ardea* the eighteenth and nineteenth vertebræ bear *free* ribs, and all seven caudal vertebræ are free. In *Nycticorax violaceus* the seventeenth, eighteenth and nineteenth vertebræ bear free ribs, and the anterior caudal vertebra anchyloses with the sacrum. The *pygostyle* is comparatively small. The epipleural appendages of the ribs are small and free.

20. Sternum of good size; its manubrium prominently developed; broadly 2-notched; four articular facets on either side for costal ribs; carina rather deep, its lower border convex and nearly the arc of a circle; dorsal aspect very concave; coracoidal grooves decussate; costal processes broad; one large pneumatic foramen in the median line above, just over anterior border.

21. Coracoid and scapula non-pneumatic; coracoid very broad below, antero-posteriorly; compressed from side to side above; scapular process small; slight differences in the two bones, at their sternal ends, due to their crossing each other. Scapula broad anteriorly, much compressed from above, downwards; apex rounded; blade rather long, not truncate, but tapers gradually to the end. Furcula non-pneumatic; upper half of each limb convex anteriorly, the reverse below; when articulated with coracoid, nearly reaches the scapula at the inner anterior angle of its head; hypocleidium has a superior and an inferior process.

22. Pelvis is rather massive; pre- and postacetabular surfaces about equal; ischiac foramen large; obturator foramen opens largely into obturator space; ilio-neural grooves sealed over anteriorly; one pair of free ribs articulate with the pelvis.

23. The humerus is the only pneumatic bone of the pectoral limb, the periphery of the orifice being in the general surface; remainder of limb well proportioned. Bones of pelvic extremity long and straight-shafted, except the fibula, which is short. In *Ardea* the fibula is short and free below. In *Nycticorax violaceus* fibula long and anchylosed with tibio-tarsus below.

24. Tendinal osseous bridge at lower end of tibio-tarsus exists and is thrown nearly square across the groove.

25. The hypo-tarsus of the tarso-metatarsus 3-crested, graduated in size, the outer being the smaller; the tendinal grooves pass between them. In *Nycticorax* the two largest crests fuse across at their posterior free margins, and convert the passage between them into a closed canal for the tendon.

26. Pes composed of well-proportioned phalanges, arranged on the plan of 2, 3, 4 and 5 joints to 1–4 toes respectively.

All of the forms of our North American representatives of the genus *Ardea* have the skull very much alike, except, of course, in the point of size. In *Ardea virescens* and *Nycticorax n. nævius* the skulls are notably very much alike, no pronounced characters, in fact, distinguishing them; while on the other hand *Nycticorax violaceus* has a skull that is at once seen to be distinguished from the skull in *Ardea* by its greater average breadth; its comparatively much shorter beak; by the form of its lacrymal bone; by the difference in the amount of interspace between the crotaphyte fossæ; and by the minute foramina for the exit of the first pair of cranial nerves as compared with the large vacuities there in *Ardea*. Finally by the vertically truncate posterior ends of the mandible, they being obliquely so in the latter genus.

The form of the *lacrymal bone* in these birds is an interesting one for whatever other morphological differences may exist between the representatives of the genera *Ardea* and *Nycticorax*, we can always distinguish the skull of the former from any of the latter, so far as our North American species go, by this bone alone. This difference pertains to the lower part of the lacrymal as set forth in my description above (compare figures of skulls of *Ardea* and *Nycticorax* given above).

While engaged upon the present memoir I have had before me skulls of *Cancroma cochlearia* and other foreign heron-forms, for which my thanks are due to the U. S. National Museum at Washington, D. C. Since that time some additional material has come to hand. Part of this is my own and part belongs to the U. S. National Museum. I find I have an imperfect skeleton of the Roseate Spoonbill (*Ajaja ajaja*); skeletons of the White Ibis (*Guara alba*), White-faced Glossy Ibis (*Plegadis guarauna*); and imperfect skeletons of a few other Ibises. There are also two or three complete skeletons of *Tantalus loculator* or the "Wood Ibis," together with a sternum and shoulder-girdle of the Jabiru (*Mycteria americana*). I have also complete skeletons of the American Bittern (*Botaurus lentiginosus*) and *Ardetta exilis*.

Among the Herons I find skeletons of *Ardea cærulea* and *A. virescens*, and some additional very complete skeletons of *Nycticorax*.

There is an interesting character to be seen in the skull of the Herons, and that is the condition of the basi-temporal bone. The entire forepart of this element is a free, triangular scale, instead of the usual small antero-median lip of it, underlapping the Eustachian entrances and arterial foramina. In *Botaurus* this character is very distinctly marked, so much so that upon a direct lateral view of the skull in that genus, nearly the entire basi-temporal is seen thus to be conspicuously individualized, and projects directly forwards as a large triangular free osseous plate, having above it a deep transverse groove.

Otherwise the essential characters of the skull in *Botaurus* are the same as we find in *Ardea*, especially in *A. virescens.*

Upon comparing the characters of the skeleton of *Ardea cærulea* with those set forth in my synoptical table given above, I find that it answers to them most perfectly, departing from them only in matters of minor detail and of but specific significance.

Botaurus has all the principal characters of a Heron in its skeleton and comes nearer *Nycticorax* than it does to *Ardea*, and is nearest to *Ardea virescens* in that genus. For instance, this resemblance is seen in such a character as is exhibited on the part of the *os furcula.* In both *Botaurus* and *A. virescens* the symphysial part is transversely broad, and the hypocleidium is absent, its position being occupied by a shallow notch. The supero-median process above it, seen in all true Herons, is also very small. Otherwise the shoulder-girdle and sternum of the Bittern are quite as herodine in character as they are in any other member of the genus *Ardea. Botaurus* has however, a few distinctive skeletal characters of its own, which, taken in connection with others in its anatomy, plainly point to its being a different genus of birds. For some distance in the pelvis, the inner margins of the ilia run closely parallel to the thin sacral crista, and it is only at one small place, anteriorly, that these bones meet the neural crest of the sacrum. But for the rest, the vertebral chain of *Botaurus* is much as it is in *Nycticorax*. This extends even to its having free ribs on the seventeenth, eighteenth and nineteenth vertebræ (see table above), instead of only at the eighteenth and nineteenth as in *Ardea.*

With respect to the long bones of the limbs, they are comparatively shorter and stouter in *Botaurus* than they are in *Ardea*, thus again agreeing with *Nycticorax;* and in both these genera the hypotarsus of

the tarso-metatarsus is the same, and is different from what we find in *Ardea* (see character 25 of the Table).

From an examination of my osteological material then, I would say that if we allow *Botaurus lentiginosus* to represent the American Bitterns, its nearest affine among the true Herons is *Ardea virescens*, and next *Ardea cœrulea;* and this connection is through *Ardetta exilis.* On the other hand, *Botaurus lentiginosus* is directly linked to the Night Herons, through *Nycticorax n. nævius*, and next in order *Nycticorax violaceus.*

Osteology of Tantalus loculator.

(Wood Ibis.)

(SEE PLATE V.)

To the U. S. National Museum I am indebted for the loan of a skeleton of this interesting species of Stork. It is complete all to the few terminal vertebræ of the tail and the pygostyle, and the skeletal parts of the sense organs. From the same institution I have also an extra skull of *Tantalus*. One skull is considerably larger than the other and is probably from a male specimen. The smaller skull probably belonged to a female bird. Both are from fully adult individuals.

Characters of the Skull.—The superior mandible is three and one-half times as long as the cranium, measuring from the well-marked cranio-facial hinge. Seen from above, it is to be observed that the cranial vault is but moderately rounded, and as broad between the supero-orbital peripheries as it is in the parietal region. The fronto-lacrymal sutures are not obliterated, but all sutural traces of the nasal bones have entirely disappeared. The superior mandible tapers gradually to a moderately decurved point. For its anterior moiety it is completely rounded from side to side, while posteriorly the sides become flat.

The external narial apertures are rather small and subelliptical in outline. They are not far separated from each other, nor are they very far in advance of the cranio-facial hinge. At the hinder part of the skull the crotaphyte fossæ fail to meet in the median line, to the full extent of a centimeter. But at the sides of the skull these "crotaphyte" or temporal fossæ are very deep, giving marked prominence to the squamosal process, while the insignificant sphenotic process is double. A narrow, elongated excavation passes down the antero-

lateral aspect of the anterior wall of the brain-case, which passes out above between these small prongs of the sphenotic apophysis. For its entire length this excavation is merely separated from the temporal fossa of the same side by a line. On this lateral aspect of the skull we are also to observe the unusual depth of the *orbital cavity* which is due to the great transverse breadth of the skull; the completeness of the roof; and the general arrangement of the surrounding bones.

The *interorbital septum* is thick and perfectly entire; the *foramen opticum* circular and small; while the foramen for the nerve of the first pair is exceedingly minute. *Pars plana* is almost completely aborted, though the *lacrymal bone* is of good size. Upon its external aspect, this latter element is flat, its lower free point being broadly rounded, and fails to reach, by quite an interval, the zygomatic bar. It makes an extensive articulation with the frontal by a broad base, and is, near its middle, perforated in the antero-posterior direction by an elliptical foramen. Sometimes this is a deep notch instead, the bone not spanning it externally. The lacrymal shows also another large foramen higher up, through which nerves and vessels pass to the rhinal chamber. The bone is highly pneumatic.

The zygoma is stout and straight, and somewhat compressed from side to side. It makes a powerful ball and socket joint with the quadrate, and at its distal extremity it becomes indistinguishably fused with the nasal and premaxillary. At this point it sends inward a horizontal maxillo-palatine plate of bone, while the mesial portion of this last-named element is of great size and composed of spongy tissue. Together with the maxillo-palatine of the opposite side it nearly fills up the rhinal space. They fuse across the median inter-palatine space with each other, and with most of the bones in the neighborhood. This open spongy mass is also carried up to the roof of the rhinal chamber on either side of the narial openings to fuse with the ventral aspects of the nasal in that locality. Posteriorly these masses rise up over and come close to the anterior free edges of the very lofty ascending plates of the palatines to a point about opposite the anterior apex of the sphenoidal rostrum.

The osseous surface of the under side of the superior mandible is extended well back; shows numerous foraminal perforations, and its lateral margins for their entire lengths, upon either side, are produced downwards as not very sharp cultrate edges.

The *palatines* are very short and broad bones; and they develop very conspicuous internal and external descending plates of bone. In front they completely fuse with other elements forming the roof of the mouth, while for the short distance between their internal descending plates they are separated from each other by a narrow, spindle-shaped space with its long axis on the middle line. Posterior to this again, and up to the point where they articulate with the pterygoid, they completely unite with each other in osseous union. Superior to this coössified portion they make a common longitudinal cavity for the rostrum, which later, by close contact, rests in the same.

The *vomer* is a long, narrow, thin and transversely compressed spine of bone. Behind, it coössifies thoroughly with the united palatines in the middle line; it then arches over to the fused mass of the spongy part of the maxillo-palatines—the concavity of the arch being below. After it reaches the maxillo-palatine mass it becomes of needle-like dimensions, and in this form, as a free spine, it is still extended forwards between them in the middle line, lying in a crease which denotes their place of fusion. This is an unusual form of the vomerine element among birds, and very different from anything we find in the Herons. Either *pterygoid* is short, stout and straight, and of a trihedral form, with sharpened edges, especially the superior one. They are in contact anteriorly when articulated *in situ*. A quadrate is comparatively large and bulky in its proportions, with powerful orbital and mastoidal processes. The latter is compressed transversely with truncated end, while the latter, somewhat twisted upon itself, has a distinct double head at its articulation. The mandibular part is massive with an arrangement of facets entirely different from what we found in the Herons. There are but *two* of these, upon either quadrate they are separated from each other by a transverse valley. The anterior facet—rather the smaller of the two—is three times as long as it is broad, and its long axis is perpendicular to the vertical median plane of the skull. With it the posterior one makes a slight angle, its outer end being the most anterior, and, at the same time, the one found below the cup for the proximal end of the zygoma. At this point the space intervening between it and the anterior mandibular facet of the quadrate is very narrow. Most of these bones at the base of the cranium are more or less pneumatic.

The Eustachian passages are open anteriorly, and the foramina for the internal carotid arteries are likewise exposed, being unshielded by

the usual antero-median lip of bone furnished by the apex of the basi-temporal. This latter is small and triangular, with its postero-basal line elevated in an unusual manner. Either paroccipital is somewhat conspicuously produced as a thickened scroll-like process curling forwards as an osseous wing to protect the aural entrance.

The good-sized *occipital condyle* is thoroughly sessile —hemispherical in form—and unnotched. Subcircular in outline the *foramen magnum* looks downwards and backwards, the plane of the occiput looking rather more directly backwards. This last-named area—broadly reniform in outline—is almost completely surrounded by a well-marked occipital crest or line. On either side below this becomes continuous with the free margins of the paroccipital processes.

A true "supra-occipital prominence" can hardly be said to exist, and there are no lateral foraminal perforations, such as we find in most species of true Ibises. A narrow, median vertical ridge divides usually the occipital area, but this does not correspond to the eminence commonly described as the "supra-occipital prominence."

This Stork possesses a powerful acutely V-shaped *mandible* the symphysial portion of which is very extensive—occupying almost the entire anterior moiety. This part is narrow from side to side, moderately decurved, rounded below and deeply concaved in the longitudinal direction above. The ramal limbs are flat and deep, especially in the region where the small ramal vacuity exists in each. Either articular cup is an extensive concavity, vertically truncated behind, and upon its blunt inturned mesial process exhibiting the usual foraminal perforation for the admittance of air into this part of the bone.

When articulated *in situ* the osseous mandibles do not come quite in contact for their posterior two-thirds, and this applies also to the superior ramal margin of either side of the lower jaw, opposite the proximal two-thirds of the zygoma. In either case the interval is of but small amount, being *less* in the latter than it is in the former.

Of the Trunk-Skeleton of Tantalus.—This is complete in the specimen at hand with the exception of all the vertebræ of the tail save the first one—the others having been lost. In the spinal column, the atlas appears to be non-pneumatic, but all the remainder of the trunk-skeleton enjoys that condition to a greater or less degree,—the pelvis and the distal extremity of the scapulæ perhaps being the least so, while it is quite perfect in the other bones.

Between the skull and the pelvic sacrum I count 21 vertebræ. All

of these are freely movable upon each other. There are no free ribs on the first 15 cervicals, but the pleurapophyses become free upon the sixteenth vertebra, though they are hardly entitled to the name of ribs.

There is a long, free pair on the seventeenth, but they lack epipleural appendages. The pair on the eighteenth vertebra, or the first true dorsal one, connect with the sternum by short hæmapophyses. This, and the three following pairs of vertebral ribs have epipleural processes, which are of no great length and are firmly anchylosed to the borders near their middles. The vertebral ribs are inclined to be flat and broad, the ultimate pair being considerably curved both antero-posteriorly, and, above, transversely. The costal ribs become gradually longer and longer as we pass backwards, and flatter from side to side. There is a pair of pelvic ribs anchylosed with that bone above, but freely articulating with the longest and last pair of the hæmapophyses below. No epipleural spines occur upon their borders.

This arrangement gives *five* pairs of costal ribs, in addition to which we find a small pair of "floating ribs." These are attached in the usual way by ligament to the posterior margins of the last vertebrocostal pleurapophysis, lapping over the articulation.

Taking the leading vertebræ of the chain to include the 17th, we are to observe that they are inclined to be massive, and closely locked together when articulated. None of their processes or spines are prominent. A low, thickened neural spine occurs on the axis vertebra, but gradually disappears on the succeeding ones, to become quite absent on the seventh, and does not again develop until we come to the thirteenth. Here it is double, the two halves inclined to come to a point in front. This is accomplished in the fifteenth cervical, where this neural process is distinctly arrow-shaped, with its apex directed anteriorly. Such also is its shape in the sixteenth, while in the seventeenth this is changed abruptly for the flattened quadrate process seen throughout the dorsal series of vertebræ.

The infero-median arterial canal is commenced on the sixth cervical, where it is open. On the seventh to the eleventh it is nearly or quite closed, to be open again on the twelfth to the fourteenth inclusive, after which it is barely evident. The lateral vertebral canals are slightly indicated even in the *atlas*, while they are complete and closed in the second to the sixteenth inclusive. We also find parial pleurapophysial spines beginning to develop on the axis vertebra; on the third they are well-marked and thickened, but becoming long

nowhere in the series, they gradually disappear after passing the ninth vertebra. The "cup" of the atlas is notched superiorly, and the postero-external angles of its neural arch are produced backwards. In the third cervical we find a short interzygapophysial bar, inclosing, upon either side, a small subcircular foramen, which is replaced by a shallow notch in the fourth vertebra. Both pre- and postzygapophyses in the second to the fifth vertebræ inclusive are exceedingly short and massive, so when these bones are articulated *in situ*, we are unable to gain a view of the interior of the spinal canal between any two of them, as we do in the case, for instance, between the seventh and eighth, on the superior aspect. The articulations among the centra are of the usual ornithic type, and the neural canal is comparatively large through the cervical chain. Elongation of the vertebræ takes place gradually from the third to the eighth inclusive, but the ninth segment suddenly assumes the general form of a dorsal vertebra. These latter are closely locked together at their articulations; are entirely devoid of hæmal processes; while their low quadrilateral neural ones are not in contact with each other in front or behind. They have metapophysial spines which project both anteriorly as well as posteriorly, but fail to meet at either point. The neural canal diminishes slowly in calibre as we near the pelvic end of the chain, but is of pretty good size throughout.

In some particulars the *pelvis* of *Tantalus* resembles that bone in the true Ibises. On the whole the bone is broad, rather shortish, and sub-compressed in the vertical direction. The postacetabular portion is but very slightly bent on the preacetabular part. Intimate anchylosis exists between the pelvic sacrum and the ilia upon either side. Viewed from above we are to note that the ilia are much expanded in front where they project considerably beyond the sacrum. Their borders are rounded here, with a pronounced emargination, while the mesial borders meet and fuse for a limited distance over the sacral crista. The fore part of this preacetabular portion of the bone for the most part faces upwards, and only outwards as it rises up on the sacrum, and forwards and outwards as it sweeps, on either side, in the direction of the acetabulæ. The "ilio-neural canals" are sealed in behind, but open, as usual, anteriorly. Passing to the postacetabular region, we find its lateral borders quite conspicuously sharpened, and where they overhang the antitrochanters — projecting. A row of interdiapophysial foramina occur in the sacrum, the holes becom-

ing progressively larger as we pass backwards. A few scattering ones occur to the outer side, on either hand. The lateral postero-external portions of the ilio-ischiac bones extend backwards for a distance considerably to the rear of the pelvic sacrum. On side view, at the extremity of these parts, on either aspect, there is seen a well-marked ilio-ischiadic triangular notch. This character also exists in the true Ibises. The ilio-ischiac foramen is large and subelliptical in outline. A pubic style is thickish, of nearly uniform calibre, projects behind considerably beyond the rest of the pelvis, and is notably separated from the lower margin of the ischium for its entire length. This latter circumstance leaves the large obturator foramen very open at its hinder boundary. A cotyloid cavity is also large, and its inner periphery is decidedly smaller than its outer one. Nothing of special note characterizes the anti-trochanter. The latter is overarched by the iliac border, above. Viewed upon its ventral aspect, the pelvic basin is seen to be deep and capacious, and the sacrum made up of 15 vertebræ. Of these, the four anterior ones throw out their lateral processes to fuse with the under surfaces of the ilia. The fifth one just barely misses performing the same feat. In the next succeeding four the processes, or such of them as are not aborted, are extended directly upwards so as to be practically out of view. The *tenth* sacral vertebra throws out powerful lateral struts to the iliac sides, just posterior to the acetabulæ. Either one of these are expanded at the extremity. This is also done by the eleventh vertebra, but in its case they are shorter and very much weaker. Still more is this the state of these processes in the last four sacral vertebræ. As I have already said, the skeleton of the tail of this specimen has been lost, all to the first segment. It resembles the ultimate sacral one, but is smaller ; it is apparently pneumatic. Its low neural spine is thick and it has no hæmal one. Most of the foramina for the exit of the nerves of the sacral plexus, on either side, are double—one occurring immediately above the other.

Passing to the consideration of the *sternum*, we find its body to be oblong in outline ; roundly and deeply concaved on its thoracic aspect, where it is riddled with minute and scattered pneumatic foramina ; and it is seen to be once well-notched upon either side of the keel behind. The lateral xiphoidal processes thus formed are slightly longer than the body, and directed posteriorly. The mid-xiphoidal projection is rather broad and cut squarely across. A costal border,

with its five hæmapophysial facettes, occupies about half the side of the bone, the spaces among the facettes being deep little concavities with pneumatic holes at their bases.

Either costal process is tilted outwards, moderately well-developed and subquadrilateral in outline. The carina runs the entire length of the body of the bone. It is deep in front and gradually grows less so as we pass posteriorly. Its lower border is uniformly convex to the front, and near the middle of its side it is strongly marked by the pectoral muscle-line. Anteriorly, its border is concaved to the front, thickened and scooped out just below the moderately developed and pointed manubrium.

Immediately below this latter process a single pneumatic foramen is seen, occupying the bottom of the upper part of the aforesaid concavity. At the carinal angle we find a large subcircular facet for articulation with the clavicular symphysis of the os furcula. The costal grooves are rather deep and they decussate. They each extend backwards to points just in front of the corresponding base of either costal process. The anterior border of the body of the sternum is markedly convex to the front, and in the mesial portion exhibits a transverse concavity. The fore part of the keel of this sternum protrudes anteriorly beyond the manubrial process. There are a number of points in this bone which disagree with the corresponding characters as they are found in the sternum of the true Ibises, the fact that it is 2-notched instead of being 4-notched, as in the latter family, being one of the most conspicuous ones.

In the *shoulder-girdle* the bones are all stout and strong. Os furcula is of the U-shaped pattern, though somewhat inclined towards the V. Its clavicular heads are elongated, thickened, each exhibiting a peculiar twist upon itself, and is distally bluntly pointed. When articulated *in situ* either of these ends are apparently only connected with the corresponding scapula by ligament. The moderately curved clavicular limbs below the free extremities are subcylindrical in form, and at the enlarged symphysis curve forwards to terminate in a bluntly pointed hypocleidium. At the posterior aspect of this latter, at its apex we find a smooth, flat, subelliptical facet for articulation with the one described above as occurring on the carinal angle of the keel of the sternum. The pneumatic foramina of this bone are found upon the mesial aspects of the distal ends near the apices.

For the size of the bird the *scapula* is a very short bone, being at the

same time thick with very little curvature to it. Its distal end is bluntly pointed, and it makes an extensive articulation with the coracoid, affording at the same time rather more than a third of the glenoidal cavity for the head of the humerus. Apparently its anterior moiety is pneumatic. A *coracoid* possesses a well-developed and curling clavicular process, while the upper end of the bone is laterally much compressed, and correspondingly deep in the antero-posterior direction. Its summit is moderately enlarged, being nearly smooth and convex on top, and rises above the clavicle when the elements are duly articulated. With respect to its shaft, we find it to be elliptical upon horizontal section, it being somewhat compressed in the direction from before backwards. As usual the sternal end is expanded, and only a rudiment of an epicoracoidal process is present. The mesial angle of this end of the bone is sharply pointed, the convex portion of the sternal facet running clear out to the end of this point on its under side. The sternal facet is continued as a concave surface over a lip-like elevation of bone, nearer the middle line, low down on the posterior aspect of this expanded end of the coracoid. No foramen is seen to pierce its shaft, as in *Plegadis guarauna*, while several sizable pneumatic foramina always occur on the inner surface of the bone below its anterior summit.

Of the Appendicular Skeleton.—*Tantalus* has an arm-skeleton of fine proportions, being at the same time well built and strong. In it the *humerus* is the only bone enjoying pneumaticity, the others lacking that character entirely. With regard to the proportionable measurements of these bones we find that the humerus has a length of 17.7 cm.; the radius 21.8 cm.; the ulna 22.8 cm.; the carpo-metacarpus 10.6 cm.; the proximal joint of index digit 4.4 cm.; the distal joint of the same finger 3.4 cm.; and the pollux phalanx 3.1 cm. No claws are found upon the fingers, and the small phalanx of medius digit has a length of 2.1 cm.

Viewed upon either direct aspect the humerus presents the usual sigmoidal curves, and its smooth shaft is elliptical on transverse mid-section. The radial crest (*crista superior*) is rather long, triangular in form, with its free border not sharp. Conspicuously developed, the ulnar crest (*crista inferior*) surrounds a capacious pneumatic fossa, but the air hole is not especially large, is single, and situated on the extreme mesial side of the fossa, near the middle line of the long axis of the shaft. The fossa seen between the smooth demi-ellipsoidal

humeral head and the prominent projection of the ulnar tuberosity, is deep, as is also the incisura capitis. At the distal end of the bone both the trochlea radialis and ulnaris are large, the large fossa above them being well scooped out. A low ectepicondylar process is developed. On the anconal side of this end of the humerus we find the usual grooves for the guidance of passing tendons, the *sulcus anconei lateralis* being the best marked.

Passing to the *ulna* we are to note that its stout, subcylindrical shaft is but slightly curved, while down its palmar edge there can be counted fourteen papillæ indicating so many points of insertion of the secondary quill-butts of the feathers of the wing. At the proximal end a good-sized olecranon process is seen, being situated directly over the fossa of articulation of the trochlea ulnaris of the humerus.

As to the *radius*, when the bones of the forearm are articulated *in situ*, it projects, distally, somewhat beyond the end of the ulna, which it there accurately overlaps. The reverse of this is the case at the proximal ends. Again, the distal moiety of the radial shaft is nearly straight, and runs parallel with the shaft of ulna, while the proximal half of the radius is somewhat curved, its concavity facing the other bone of the antibrachium, or the ulna. The shafts of these two elements of the forearm come in contact then only at their extremities, thus creating an elongated interosseous space, which is of greatest width proximad. Two free *carpal bones* are present, having the usual ornithic characters. This latter remark might also be applied to the *carpo-metacarpus*. Regarding it, however, we would say that its main shaft (index metacarpal) is very straight, and has a calibre about one-third greater than that of the middle third of the shaft of the radius. Its curved medial metacarpal is far slenderer, and stands well away along its continuity from the main shaft. Proximad, where it fuses with it, it is considerably expanded from side to side, while distally, where it joins the index metacarpal again, it is seen to be not quite as long as the latter. Pollex metacarpal is very short and projecting. The articular surfaces of all the bones entering into the composition of the carpus are as we find them in birds generally, that is, of the ordinary species.

The proximal phalanx of index digit is rather elongate with its expanded part not markedly developed. This latter part has a small, distinct process distally which projects beyond the true shaft-part of the bone. It also has, on its palmar surface, an oblique ridge, divid-

ing the shallow concavity there formed into two nearly equal fossæ. Transversely, the head of this bone is wider than the distal end of the index shaft of the carpo-metacarpus which articulates with it. *Medius digit* presents nothing peculiar; it has the usual small process-like elevation upon its hinder border, and when articulated *in situ* is closely pressed for nearly its entire length against the first joint of the index finger. The trihedral terminal phalanges of pollex and index digits are much alike in their morphology, and depart in no striking character from what we see in those bones in all large ordinary birds. Small free sesamoidal bones seem to be absent from about any of the articulations of this arm-skeleton of *Tantalus*.

In the matter of development the *pelvic limb* is equal to the pectoral extremity, but the relative proportions of the corresponding bones of the three first segments is quite different. For instance, the femur has a length of 10.3 cm., while the tibio-tarsus is 26.5 cm. long, and the tarso-metatarsus measures 21.1 centimeters. Of course, in this, the fingers and toes do not enter into a comparison, and we would simply add that the mid-anterior toe has a length of about 10.7 cm. The basal phalanx of the outside toe is the longest of all the joints of pes, measuring 5 cm.; that of the middle toe being 4.2 cm. and of the inside one 4.4 cm. The free first metatarsal bone is 2 cm. long, and the basal joint of hallux has a length of 4.0 centimeters.

As in the case of the humerus of the arm, the *femur* is highly pneumatic, none of the other bones of this limb enjoying that property. A large, single pneumatic foramen, subelliptical in outline, is found on its anterior aspect near the summit, and just in front of the trochanter. Other minute ones occur in the rotular channel between the condylar crests. This bone is quite straight with smooth cylindrical shaft upon which the usual muscular lines are but faintly marked. Antero-posteriorly, the great trochanter is of considerable width, and its crest rises conspicuously above the smooth articular summit of the shaft. The large, globular and sessile caput femoris exhibits on its upper surface a well-circumscribed pit for the insertion of the round ligament. At its distal extremity we are to note the unusual depth of the rotular channel in front, giving, as it does, great prominence to the condyles in that region. These last are of themselves large, with their lowermost points being very nearly in the same horizontal plane. Posteriorly, the external condyle is powerfully developed and very prom-

inent. It is also deeply cleft for articulation with the head of the fibula. The internal condyle is here markedly flattened. Above them, the popliteal fossa, though circumscribed, is quite deep. It is made so more particularly by the form of the internal condyle, which has a sharp, elevated internal border carried up for a short distance upon the shaft, and a ledge-like connection with the external condyle, the flat upper surface of which forms the distal side of the popliteal fossa. The *patellæ* are not present in my specimen, and *Tantalus* may either not possess those sesamoids, or they may have been lost. I am inclined to believe the species does not have them, and they are not present in *Plegadis guarauna.*

The wonderfully long shaft of *tibio-tarsus* is perfectly straight for its entire continuity until we reach a point immediately above the condyles of the distal extremity ; at this point it makes barely a perceptible turn forwards. The posterior and lateral aspects of this shaft form one continuous rounded surface, while the anterior aspect is nearly flat, with a gradual and very slight inclination to become longitudinally grooved at the junction of the lower and middle thirds for a distance extending over about 3 centimeters. On the summit of the bone the articular surface is nearly level and the entire width of the cnemial crest is developed but a short distance above it. Pro- and ectocnemial processes are produced hardly at all down upon the front of the shaft, but otherwise they are in no wise reduced, and exhibit the usual ornithic characters. Almost immediately below the external one we find the fibular ridge commencing, and this, after extending down the shaft for a distance of about 3 cm., terminates somewhat abruptly. At the distal extremity the condyles are of a size in proportion with the other parts ; they have the ordinary reniform outline ; and one of them is no lower on the shaft than the other. They project beyond the latter about as much posteriorly as they do in front. But the intercondyloid groove is decidedly shallow both below and in the former situation. Anteriorly, however, it is very deep, and at its upper part here forms a distinct rounded concavity. This is intended for the reception of the conspicuous and rounded process situated on the antero-median aspect of the summit of the tarso-metatarsus, when that bone is powerfully flexed upon the leg. Above the just-mentioned concavity, the bone also juts out a little ways, thus forming an abutment to add additional security to the articulation. Just internal to this is the very small lower aperture of the tendinal canal. The proximal

aperture is hardly any larger, while the overspanning osseous bridge is thick and strong. Proximad to these characters again, the anterior aspect of the tibio-tarsal shaft is inclined to be slightly grooved for a very limited distance. Nearly opposite each other on the borders of this are two osseous tubercles. They are intended for the attachment of the ligament which holds in place some of the tendons during life.

Fibula is strongly developed above the point where it articulates with the fibular ridge of the tibio-tarsus. Then it begins gradually to dwindle in size, and near the middle of the latter bone, fuses indistinguishably with its shaft. We would note also, that its ligamentous attachment with the fibular ridge of the tibio-tarsus is extremely close for the entire length of that projection.

On the summit of the *tarso-metatarsus* the concavities for the tibio-tarsal condyles are deep, and standing between them in front is the very pronounced articular process mentioned above. The short and massive hypotarsus exhibits a wide and deep median longitudinal groove for the tendons. The free edges of its sides are thickened and each turned outwards away from the central excavation.

To the outer side of the external aspect of this hypotarsus, and to the inner of the inner side of the internal one, there is a foraminal aperture, which passing through the shaft of the bone, in either case, makes an appearance anteriorly immediately above the very distinct and double tubercle for the insertion of the tendon of the tibialis anticus muscle. This hypotarsal enlargement makes but a feeble attempt to an extension down the shaft behind. As to the shaft itself, it is quite straight throughout. Its sides are flat, it being somewhat grooved longitudinally for its entire length posteriorly, and very much more profoundly so, anteriorly. In the latter case the groove is carried from the summit down to within a short distance above the large subelliptical perforating foramen of the anterior tibial artery, and even this last has a deep and narrower groove running into it from above. All the distal trochlear processes are well-developed. The central one is the lowest on the shaft, the two lateral ones descend about equal distances, and then each turns in behind towards the median axis of the bone. Between these trochleæ the spaces dividing them are rather wide, thus lending to the processes themselves a notable distinctness. The median one is clearly marked by its articular groove for its entire extent ; in the case of the other two, the groove is not at all evident in front ; only faintly so distally, but becomes very manifest posteriorly.

The free *first metatarsal* is articulated in the usual manner. Its facet on the metatarsæ is elongated, being on the lateral edge of the shaft about a centimeter above the internal trochlea. As to the accessory metatarsal itself, it is somewhat twisted; expanded proximally; and bears distally the usual trochlea for articulation with basal joint of hallux. The joints of *pes* are upon the normal arrangement, that is, 2, 3, 4, 5 for first, second, third and fourth toes respectively. They are proportioned, present nothing peculiar, and their principal measurements have been given above.

The terminal or ungual joints are rather short, inclined to be weak, are pointed distally, and show scarcely any curvature,—really none at all,—in the antero-posterior direction. This also applies to the intermediate phalanges between them and the trochleæ of the tarso-metatarsus.

On the Sternum and Shoulder-girdle of Mycteria: Taken in their main characters, these parts of the skeleton in the Amazonian Adjutant (Spec. 11511, S. I. coll.) agree more or less with the corresponding ones as we have described them above for *Tantalus*. There are a number of important differences however, as, for example, the coracoids in *Mycteria* do not discussate in their sternal beds, but are separated by an interval of several millimeters of bone. *Mycteria* again, has but *four* hæmopophysial facets upon either costal border of the sternum, and the latter bone is relatively shorter and more massive. In front, the manubrium is entirely aborted, while posteriorly it is 2-notched in a manner quite similar to what was found in *Tantalus*. It is highly pneumatic, its thoracic surface very deeply concaved, being actually riddled with various air-holes. Peculiar transverse and irregular corrugations occur upon the same aspect, the pneumatic foramina occurring in the intervals between them. The carina is of great depth, and somewhat swollen in its anterior moiety by a pneumatic cavity. The upper half of the anterior carinal border presents a deep longitudinal excavation, at either basal end of which exist pneumatic foramina leading into the carinal swelling mentioned in the last paragraph. Strong muscular lines mark the sides of the keel, and the ventral aspect of the body of the sternum. The several bones of the pectoral arch resemble those of *Tantalus* in general form. They are also pneumatic. *Os furcula* however, is more of a decided U-pattern, though its symphysis below makes the same articulation with the carinal angle of the sternum, as occurs in *Tantalus*. The apices of the free clavicular

ends of the arch are connected in life with the scapulæ by an interval, on either side of ligament, which likewise agrees with what we found in the Wood Ibis. A rudimentary epicoracoid process is found upon either coracoid, and the anterior extremities of these latter bones are laterally compressed, and when the elements of the girdle are articulated *in situ*, they stand but very little above the clavicle upon either side.

Each *scapula* is short and thick, being bluntly pointed at the distal end. Scapula also shows a general curvature along its continuity, being somewhat more marked than it is in *Tantalus*, and, what I should have said above, the lower border of the keel of the sternum is decidedly more convex than it is in that bird. When the several bones are articulated as in life, the long axis of a coracoid is almost parallel with the imaginary line representing the long axis of the body of the sternum. The scapulæ articulate, each with its corresponding coracoid at an angle of about 86°, and the long axes of the clavicular heads of the os furcula are about in line with them, on either side; while the plane in which the remaining part of the furcula may be supposed to exist, is parallel to the long axes of the coracoids. Either clavicular head of the furcula is extensively and rather closely applied to the mesial side of the coracoid where it articulates, and about a centimeter beyond this, the limbs at once curve down in the direction of their symphysis. The very thickish hypocleidium bends abruptly forwards—its posterior aspect being entirely applied to the facet occupying the carinal angle.

ON THE SKELETON IN THE IBISES.

(*Guara alba, G. ordii, and Plegadis guarauna.*)

(SEE PLATE IV.)

Of the axial Skeleton:—Osteologically, these birds are very different from *Tantalus*. Viewed from above, the *cranium* is seen to be rounded and smooth, with the superior margins of the orbits wide apart. These latter borders are not sharp, but rounded off. In the frontal mid-region, just posterior to the premaxillaries, it is inclined to be concaved in *Plegadis*, and markedly so in *Guara alba*. In the former genus, too, there is a median longitudinal furrow, which is absent in the White Ibis. Both are schizorhinal birds, especially in the case of *Guara*, where the narial apertures are very narrow, elong-

ated slits, and the premaxillary processes of the nasal bones are defined.

The long, curlew-like superior mandible is very much decurved, and the culmen is rounded off. It is roughened towards the tip as in certain snipes, and, as in them, somewhat transversely dilated distally. The extreme apex is bluntly rounded. On the posterior aspect in *Plegadis* we find the supraoccipital prominence very conspicuous, and upon either side of it, a large, subelliptical foramen. These two characters are not so strong in *Guara*, where the foramina are relatively, as well as actually, smaller and more elongate. In this genus, however, an "occipital ridge" is pretty well marked, and it is not so evident in *Plegadis*. The crotophyte fossæ are, mesially, well separated.

Upon lateral view, we notice that the anterior end of the narial slit in the beak is extended forwards as a narrow split aperture more than half way towards the extremity, as it is in the Curlew (*Numenius*). Ibises, however, have the separated premaxillary limbs thus formed, far more rigid than they are in the Curlews. This is due to the fact that the maxillary fork of the premaxillary is deeper and stouter in the Ibises, and it is more firmly held in place by the enlarged and united maxillo-palatines within. *Plegadis* has a very slender and straight zygoma, with its maxillary end completely fused with, and much hidden by the bones surrounding it. The free bar of the nasal bone, or that portion passing between the frontal region and the maxillary process of the premaxillary, is straight and flattened.

A *lacrymal* makes a very extensive and close union with the edge of the frontal bone and nasal. Actual anchylosis, however, does not take place along the line of the suture. Its superior portion is subhorizontal in position and from this part it sends inwards a distinct process towards the rhinal chamber; and downwards a broader and antero-posteriorly flattened process towards the maxillary. This latter bone it reaches by the intervention of a well-developed osseous rodlet representing an *os uncinatum*. This descending process of the lacrymal also sends directly inwards a small process that touches the tip of a similar one sent outwards on the part of the small quadrate *pars plana*. The anterior wall of the brain-case is entire, as is also for the most part the interorbital septum. The foramen for the exit of the first pair of nerves is nevertheless much cut away; while on the other hand the foramen rotundum, and the smaller nervous foramen to its outer side, are not so very much larger than is required to pass the nerves they

are severally intended for. Each orbital cavity is then moderately deep, its general shape being subhemispherical. Comparatively, however, the orbit of this Ibis is not so deep, nor so thoroughly surrounded by bony walls, as it is in *Tantalus.* A temporal fossa, as seen on this lateral aspect of the skull in *Plegadis* is narrow, fairly well deepened, and elongate in the antero-posterior direction. The squamosal and postfrontal processes are small. The entrance to the aural cavity is considerably shielded by the bony rim that surrounds it, while we are to note that the *foramen ovale* makes encroachment upon its anterior precincts. But little importance distinguishes a *quadrate bone.* Broad and quadrate in outline, its orbital process is squarely truncated at its free inner extremity. There is a double facet upon the mastoidal head, while the mandibular facets are but feebly carved out. As compared with *Tantalus,* these latter are somewhat differently disposed, especially the innermost one, it being markedly angulated in the Ibis and strictly transversely placed in *Tantalus.* *Os quadratum* in both genera possess a small hemispherical facet for articulation with the proximal end of a pterygoid; while the broad outer projection presents upon its supero-external aspect the usual little pitlet for articulation with the peg-like process on the inturned end of the proximal extremity of the zygoma. It will be as well to say nere in passing that the facets on the mastoidal head of the quadrate bone in *Tantalus* are much more distinctly separated than they are in *Plegadis.*

Turning to the base of the skull we find the foramen magnum to be of large size and subcordate in outline. In some specimens its superior margin is closely approached by the supraoccipital foramen upon either side, lending to the postero-basic aspect of the cranium in this region a very open appearance. The occipital condyle is very small for a bird the size of *Plegadis,* and it is seen to be sessile, with a faint notch on its supero-mesial side. Immediately posterior to the aural cavity, upon either side, there is developed a strong and distinct descending paroccipital process—a character practically aborted in *Tantalus.* Within these, and still further forwards, we observe small circumscribed pits, one on each hand, that give passage to vessels and nerves through foramina at their bases. The basitemporal area, triangular in outline, is of fair size, while its anterior angle as a free scale-like tip underlapping the openings to the Eustachian tubes. These are open channels for the best part of their extent in front, being covered over only just before arriving at either aural cavity.

The rostrum is rounded beneath and carried to a distinct pointed process anteriorly. Above this, as the anterior ethmoidal margin, it is carried obliquely forwards and upwards to finally spread out and give support to the fore part of the cranium in the facial region, at its inferior surface.

Ibises lack basipterygoidal processes, and the pterygoids stand far away from the lower part of the brain-case.

A *pterygoid* is of good size, and may be said to be truly twisted upon itself, with its hinder half very much compressed from side to side, as is its anterior moiety similiarly compressed in the opposite direction. Its anterior outer border is exceedingly sharp and thin. When the pterygoids are articulated as in life, they make an extensive articulation with pterygoidal heads of the palatines as they do with each other beneath the spheroidal rostrum. This is also the case in *Tantalus*, and the bones are not altogether in the two genera. From side to side, the *palatines* are very narrow bones. Posteriorly for a notably small part of their extent they are tightly pressed together, and form on their upper aspects in this locality a short longitudinal groove for the reception of the rostrum. In passing forwards they are quite parallel to each other, and thus beneath the maxillo-palatines to become, in the adult, completely and indistinguishably fused with the other bones. Upon their under sides posteriorly, each one sends down both an internal and an external lamina of bone. These plates are about of equal proportions, and the postero-external angle of the outer one is completely rounded off. Anteriorly, and upon their upper aspects, the palatines develop extensive ascending processes or plates, which have their planes nearly parallel to each other. These, when we regard the skull upon its lateral aspect, shut the free part of the sphenoidal rostrum out from view, and the entire anterior border of either one of them has resting upon it, the large maxillo-palatine of the same side. *Plegadis*, as in the case with other American Ibises, has a long, very slender, and anteriorly pointed *vomer*. This bone is completely anchylosed with the palatines behind, exhibits barely any curvature as it passes forwards, while its extreme tip just reaches the maxillo-palatines at the point where those bones fuse across the interpalatine valley. This vomer has only two points of contact then, and these are at its extremities, it being nowhere else anywhere near the surrounding bones. There is no doubt but that in very old Ibises the palatines anchylose with each other in a very thorough manner. One specimen

in my collection exhibits this condition, and it agrees with what we find in *Tantalus* and its palatine bones. In fact, as different at first sight the bones at the base of the skull appear to be in *Tantalus* and these Ibises, they are fundamentally the same in character. The *maxillo-palatines* are large, spongy bones, completely overlaid with a thin coating of compact tissue. Posteriorly, they extend far backwards and are here well-separated from each other, the entire interpalatine space and the vomer standing between them. In this region too, they mount well up into the rhinal chamber occupying much of its room.

Between the maxillaries and immediately in front of the apex of the vomer their behavior is very different. They here cross the median space to completely fuse with each other, and that for a distance for at least a centimeter in front of the vomerine spine. This desmognathous condition is not quite as complete, or rather quite as extensive, as it is in *Tantalus* for example, because in front of those fused maxillo-palatines in the Ibis we again meet with another open vacuity in the middle line, which may be a centimeter or more in length. It usually extends as far forwards to a point nearly opposite the anterior terminations of the external narial apertures, which, of course, are above it. We may add here, what perhaps should have been said in another place above, that we find a small foramen above either *pars plana*, for the passage of the nasal nerve, and the supero-anterior part of one of those mesethmoidal wings is turned forwards in a peculiar manner, so as to form between it and the mesial ethmoidal plate proper a deep fossa, open in front and below. *Plegadis* has the osseous circlet of sclerotal plates in the eyes complete as in other birds, but the individual pieces are each very small and overlap their fellows all round for at least a third of their surface, the arrangement gives a large pupiliary aperture, and the posterior plates are but slightly larger than the anterior ones. Ear bones have been lost in all my present specimens, as have those of the hyoidian apparatus.

Coming to the *mandible* we find it decurved in a manner to correspond to the upper bill. This curvature is general from one end to the other. The anterior ramal symphysis is very extensive, extending back for nearly or quite half the length of the bone. Below, it is deeply grooved in the middle line from the apex to where the symphysial part terminates posteriorly. This grooving is also seen upon the superior aspect, but much more fully marked. A similiar longitudinal groove also occurs down the entire middle line of the superior mandible

upon its under side, and as in the case of that part of the bill, the lower jaw has also a slight dilatation at its distal end. The posterior half of the mandible is acutely V-shaped, its upper and lower ramal borders being rounded and not sharp. The sides increase in vertical depth as we proceed towards the articular ends, and the ramal vacuities do not exist. There is a sizable ramal perforation or foramen however, further back on either side, near the point where the temporal muscle makes its insertion. Each articular cup is rather small, though its internal process is well-developed and the posterior one even still better. These posterior articular processes are absent in *Tantalus* but present in *Ajaja*. Here in *Plegadis* they each spring from the extreme external and back part of the articular extremity, and each has to its inner side a concavity which occupies the true posterior aspect of either articular end of the mandible. This part of the bone is pneumatic, but the air-holes are very small, and found further from the apices of the internal articular processes than is usually the case in most birds.

Seventeen vertebræ are to be found in the cervical region of the spinal column of *Plegadis*, before we arrive at that one the ribs of which are joined to the sternum through the articulation of hæmapophyses or costal ribs. This is the eighteenth vertebra, and it together with the nineteenth, twentieth and twenty-first are solidly anchylosed together so as to form one bone, such as we find among the typical gallinaceous fowls. The twenty-second vertebra is free and stands between this compound dorsal piece and the sacrum of the pelvis. This latter has fourteen more vertebræ in it, they being fused together as in the sacra of all ordinary birds. In the skeleton of the tail we find five vertebræ, and to these is to be added the pygostyle. Thus it will be seen that this Ibis has forty-one vertebræ in the skeleton of its spinal column, plus a pygostyle, which is probably composed of several others.

There is a tiny pair of free ribs, of the most elementary character, on the sixteenth vertebra; the free pair of the seventeenth are rather long and slender, and are possessed of uncinate processes. Then follow six pairs of *true ribs*, all of which unite below with the sternum by means of connecting costal ribs. The last pair is a pelvic pair and they lack unciform processes. All the rest have these, though they become progressively smaller as we pass from the ribs of the eighteenth vertebra to those of the twenty-second. These unciform processes anchylose with the several ribs to which each one belongs. These ribs are narrow, very thin and slender, and from first to last

gradually increase in length and curvature. The costal ribs are also much compressed from side to side, and are graduated in a similar manner.

Considering the *vertebræ* of the *cervical region* from the first to the seventeenth inclusive, we are to observe that the characters they individually present are for the major part quite different from those found in the corresponding vertebræ in the neck of either *Tantalus* or the Herons. The *atlas* has a broad and deep neural arch, with its postero-external angles produced. Its articular cup is notched superiorly by the odontoid process of the axis. Below, it has a bifid hæmal spine, and its other characters are quite of the common ornithic type. In the axis vertebra there is a low, thickened neural spine, with a rather longer, better developed and more pointed hæmal one. This vertebra also has a completed lateral vertebral canal, with parapophysial spines projecting from them behind. These spines are longest on the third vertebra, and the fourth. On the fifth they show signs of shortening, which is decidedly the case in the sixth cervical, after which they rapidly shorten throughout the series as we pass backwards, to become quite absent in the twelfth. There is also a progressive lengthening of these vertebræ from the third to the eighth inclusive, they becoming at the same time more slender in appearance. From the ninth backwards they gradually shorten and thicken again until they finally assume the form of those of the predorsal ones. Semi-aborted neural spines are found upon the third, fourth, fifth and sixth cervicals, being entirely absent on the seventh, and do not again appear till we come to the thirteenth where this process is bifid. On the fourteenth it is represented by a single median tubercle, while on the fifteenth to the seventeenth inclusive it is elongated and plate-like. Lateral vertebral canals extend throughout the series from the second to that vertebra which first bears free riblets. In the middle of the chain, the pleur- and parapophyses closing them in are rather broad and deep. The infero-median hypopophysial carotid canal commences with the fifth vertebra, where it is open and rudimentary. It is nearly closed on the sixth, to become completely so on the next following one. After this its walls are unusually complete, and antero-posteriorly deep. This condition obtains until we come to the twelfth cervical where we find it small and open again. In the thirteenth its place is occupied by a single, plate-like hæmapophysial spine, but this latter character rapidly aborts

in the succeeding vertebræ, to include the seventeenth. The articulations among the second, third, fourth and forepart of the fifth are very close, the zygapophyses being short and thick, and no intervals among the bones occur here. As we pass backwards however, the postzygapophyses gradually lengthen, and meeting the short, elevated prezygapophyses with their facets facing the median plane, large lozenge-shaped vacuities occur down the chain as far as the thirteenth vertebra. In the third and fourth vertebræ small interzygapophysial foramina are present, one on either side. Among these vertebræ the articulations of the centra are of the usual ornithic type, and the elongated bodies of the fourth to the eleventh inclusive are flat both ventrally and laterally. The twelfth cervical is very flat and broad on its dorsal aspect, it there having the form of an arrow-head with the point to the front, and the lateral projections being represented by the postzygapophyses, with their facets under the ventro-posterior sides. This condition is to some extent foreshadowed in the eleventh vertebra, but quite disappears in the thirteenth.

For the fore part of the skeleton of the neck, the neural canal is of rather small calibre, particularly in the anterior end of the vertebræ, but it gradually becomes larger as we approach the dorsal region.

In the tenth to the eleventh inclusive, upon either side, we observe a very delicate osseous loop passing backwards from the pleurapophysial part of the bone to the side of the centra of the same vertebra, where it again coössifies. These loops are immediately above the lateral vertebral canal, and are absent in all the other vertebræ. We find no such arrangement, however, in the skeleton of the neck among these Ibises as we described for the Herons and Bitterns, any more than is there in *Tantalus*.

Omitting the twenty-second vertebra, the low neural spines of all the dorsal vertebræ are completely fused together, as are the outer extremities of their diapophyses, the latter by strong and broad metapophysial coössified connecting bands. Hæmal spines are present upon the eighteenth and nineteenth dorsals, while the centra of the eighteenth to the twenty-first inclusive are fused together in such a complete manner that the points of union are scarcely distinguishable. The twenty-second vertebra possesses characters intermediate between hose of the twenty-first and the anterior vertebra of the pelvic sacrum.

If we omit perhaps the atlas, all the vertebræ of the cervico-dorsal region of the spine with their ribs and hæmapophyses, as well as the

major portion of the pelvis, are more or less pneumatic. The caudal elements do not seem to enjoy this condition.

There is considerable difference in size in the skeletons of the male and female *Plegadis*, and this difference is very well seen in the pelvis of the two sexes. In the male the *pelvis* has a length of 6 cm. and an extreme width of 3.7 cm., the first measurement being a medium one, taken between the anterior points of the ilia to the line of articulation between the posterior extremity of the sacrum and the first vertebra of the tail. Measuring the pelvis of a female in the same manner, we find these lines to be respectively 5.2 cm. and 3.1 cm. in length and width. Upon the dorsal aspect we find the anterior margins of the ilia to be transverse, with their antero-median angles slightly produced forwards. These bones here extend somewhat beyond the first vertebra of the sacrum. Their preacetabular portion is concaved and smooth, having the surface upon either side looking forwards and outwards posteriorly, the direction gradually changing as we pass to their anterior ends so as at last it comes to face almost directly upwards. Mesiad, they completely fuse with the superior border of the sacral crista, and in such a manner as to entirely close the neural canals behind.

Passing to the postacetabular region, it is seen that the mesial margins of the ilia do not fuse with the external borders of the sacrum, while the latter, being of the elongate-lozenge form, has a very regular double row of interapophysial foramina down its length. These foramina begin small anteriorly and gradually increase in size as we proceed towards the tail. The superficial surface of the postacetabular part of an ilium is about half as wide as it is long, being moderately convex anteriorly and concaved behind.

Posteriorly, both ilium and ischium project considerably beyond the hinder end of the sacrum. On a side view of this pelvis we find the inner ring of the cotyloid cavity to be rather smaller than the outer one; the antitrochanter is small; while the ischiac foramen is of good size, and broadly elliptical in outline. Posterior to this latter the side of the bone is much concaved, and distally there is a sharp angular notch existing between the ilium and the ischium, similar in character to the one found in *Tantalus*. The lower ischial margin is sharp, and it is only the extreme postero-inferior angle of this bone that comes in contact with the upper border of the corresponding pubic style. This leaves between them an open obturator foramen, and an elongated

obturator space. Each pubic bone is a long slender style of nearly uniform width, extending backwards far beyond the rest of the pelvis or even slightly beyond the pygostyle of the tail. These pubic elements are pointed at their distal ends, and are throughout gently curved, much after the manner of an *ſ*.

As the sides of this pelvis behind are nearly at right angles with the roof, we have as a consequence quite a roomy pelvic basin, more or less protected by bony walls. In front, on this ventral aspect, we find the first four leading sacral vertrebræ, having their lateral processes thrown out against the under sides of the ilia. That vertebra which is opposite the acetabulæ behaves in the same manner, and in its case the extremities of the apophysial braces are much dilated in order to be more efficient. Between this vertebra and the fore end of the sacrum, the latter takes on the usual enlargement for the accommodation of the sacral enlargement of the spinal cord in that locality. Foraminal perforations for the exit of the nerves of the sacral plexus are double in apparently every case, and, as in other birds, one is placed above the other.

Skeletons of the tail show a number of points indicative of feebleness of development in these Ibises. In the first three the diapophyses are not large, and although they have low neural spines, they are lacking entirely in hæmal ones. The remaining vertebræ are even still more rudimentary, and although they may have minute evidences of a hæmal spine or hypopophysis, they are much aborted in all other directions. Lastly, the pygostyle is much elongated, transversely compressed, small and narrow, and almost as weak as that bone as we find it in certain Grebes. These Ibis-birds have a very light and pneumatic *sternum*, that is very much concaved upon its dorsal aspect, where the anterior wall is especially developed and nearly vertical to the body of the bone. Its inner side in the middle line is fortified by a thickening, at the base of which occur a few minute pneumatic foramina, as there do also a few to the right and left of it. These openings are not seen elsewhere on the sternum, except in the pitlets beween the small hæmapophysial facettes upon the costal borders.

The sides in front are well-elevated above the thickened anterior border, though the costal processes are much truncated off, and thus made triangular in form. Posteriorly, this sternum is markedly four-notched, and the pair of lateral xiphoidal processes on either side are rather long and slender,—the median one very considerably stouter

and longer. The mesial notches are a little deeper than the outer ones. A costal border occupies about one half of the lateral margin of the bone. The carina extends the entire length of the sternal body, and is wonderfully deep in front, where it is thickened just within its sharpened border.

The lower border is very thin, and the carinal angle is one of about 90°. On the lower or ventral aspect of the sternal body we find the main pectoral muscle-line well marked.

Either one extends from the outer end of a costal groove back to the distal point of the base of the carina, or nearly there. As in *Tantalus* and the Herons the costal grooves decussate and are remarkable for containing transverse, narrow, elongated, low, articulate eminences, which convexities are intended to accommodate similar concavities seen at the sternal ends of the coracoids. Now although the costal grooves of the sternum decussate in all the birds we have just mentioned, it will be as well to add here, in passing, that the characters of the facets of those grooves and other points about them are quite different in the several groups. There is a small peg-like manubrium present on the sternum of *Plegadis*, as is the case in the sterna of its immediate ibine allies, and, as a whole, this bone differs but little among the American genera of these birds. When the elements of the *shoulder-girdle* are articulated *in situ* the long axes of the coracoids are nearly in the same line with the long axis of the body of the sternum, and the os furcula not only curves well away from the former, but its symphysial portion is far removed from the anterior border of the carina of the latter. The scapulæ have their distal apices immediately opposite and above the anterior margins of the ilia of the pelvis, and they, as a whole, are well elevated above the osseous parietes of the thorax.

Os furcula is of the broad U-shaped variety. It is of nearly uniform thickness and width throughout, with its clavicular limbs much compressed laterally, and their free ends very bluntly rounded off. As we near the symphysis below, the surfaces gradually become reversed, so that what was the mesial aspect of either clavicle above, comes to face below as the anterior surface of the symphysis of its own side, as does the outer aspect of the clavicle come to be the posterior symphysial surface. The merest rudiment of a hypocleidium exists, scarcely worthy of the name. During life the distal end of either clavicle overlaps and is in contact with the top of the head of the

scapula of its own side, resting also a very little on the scapular process of the coracoid.

A *coracoid* is comparatively rather a short bone, being somewhat compressed in the antero-posterior direction. Its scapular, wing-like process is well produced, and is perforated by a small foramen near its center. As usual, its sternal end is expanded, and an elongated concavity occupies its inferior border, it being intended for the long convex facette in the coracoidal groove of the sternum, which was described above. There is a rudimentary epicoracoid process present. Superiorly, the summit of the coracoid exhibits the ordinary tuberous head, and below this for a limited distance the shaft position, irrespective of the scapular process, is laterally compressed. With the aid of a scapula it forms, in the usual manner on either side, the glenoid cavity, which is of good size in these Ibises. A *scapula* has a cimiter-like blade, which gently along its continuity is curved outwards. It is smaller at its neck than it is distally, where it is obliquely truncated from within outwards, a circumstance which gives a sharpened distal apex. Its posterior portion is thin and flat, and somewhat broad; its neck is thicker. With the scapular process of the coracoid it makes an extensive articulation, and mesially is overlapped with the end of the clavicle. All these bones of the pectoral arch are undoubtedly pneumatic, but owing to the extreme smallness of the foramina those openings are found only after careful search.

A male *Plegadis guarauna* has a scapula 5.6 cm. long, and a coracoid 4.0 cm. high; the same bones measuring in the female 4.9 cm. and 3.6 cm., respectively. In taking the lengths of the coracoids we measure them from the highest point on the summit to the minute process seen at the outer termination of the facette of the sternal extremity.

The Pectoral Limb: As in *Tantalus*, so in *Guara* and *Plegadis*, the *humerus* is the only pneumatic bone of this part of the skeleton. In *G. alba* it has an average length of 10 cm., while in *P. guarauna* it rarely exceeds 9 cm. Of course, it is relatively as well as actually shorter in the females. Apart from this matter of size, the bone has the same general characters as we have given them above for *Tantalus*. In these true Ibises, however, the radial crest is better developed, and its free convex border presents an unusually regular curve, resembling the arc of a circle. Moreover, the expanded portion of the proximal end of the bone is shorter than in *Tantalus*, but the single pneumatic foramen holds the same position in the three genera. In a male

Plegadis guarauna the *ulna* measures in length 10.9 cm. and the hand in the same specimen is 9.5 cm. long.

The essential characters of the bones of both the antibrachium and pinion agree in both *Guara* and *Plegadis*, but the row of osseous papillæ down the shaft of ulna are almost obsolete in the latter genus, while in the White Ibis they are very strongly marked—relatively stronger, even, than in *Tantalus*. At the same time, the ulna and the radius ; the carpal segments ; the various bones of manus, have in general the same essential characters in these true Ibises as we found in the corresponding bones of *Tantalus*. This does not pretend to take into consideration either the matter of size or of relative lengths. These of course differ, although not so very much in the latter respect.

The Pelvic Limb : The characters exhibited on the part of the bones of this lower extremity are almost identically the same in *Plegadis* and *Guara ;* and in neither genus is the femur pneumatic as we found it to be in *Tantalus ;* and the shaft of this bone is relatively longer in those genera also, than it is in the last named genus. Otherwise the characters are much the same all round, and at the distal end of the femur in either *Plegadis* or *Guara* we find the same big condyles, with the deep " rotular channel " between them in front, and, indeed, all the other principal characters described above for *Tantalus*. With equal truth this applies to the bones of the leg, the tarso-metatarsus and pes. In the tarso-metatarsus, however, the longitudinal groove down the back of the shaft of that bone, is by no means so well marked in *Plegadis* as it is in *Tantalus*. It is particularly deep in front in *Guara*, but does not there extend more than half way down the shaft.

In *Plegadis guarauna*, in the same male specimen as I used above, I find the tibio-tarsus to have a length of 13.7 cm. and the tarso-metatarsus a length of 10.5 cm. These measurements are relatively very different in *Guara alba*, for in the same bones, respectively, we find the lengths to be 12.6 cm. and 8.7 cm.—showing about a centimeter's difference in the tibio-tarsi, but nearly two in the case of the tarso-metatarsi. *Guara* is the shorter legged bird, without having lost any skeletal alar extent with respect to the pectoral extremity.

Notes on the Osteology of the Roseate Spoonbill. (*Ajaja ajaja.*)

(SEE FIGURES 38, 39, 40 AND 41.)

As I have before said, my material, illustrating the osteology of this

interesting form, is incomplete. We have a skull, however, and I also find the bones of the extremities.

Of the Skull : Regarded from above, it is seen that the vault of the cranium, including an area bounded by the occipital ridge, the orbital peripheries, and the anterior terminations of the frontal bones, is smooth, completely convex and rounded, being unmarked by either elevation or depression of any kind. In the frontal region the transverse line measuring the shortest distance between the very rounded orbital margins, usually averages about a centimeter and a half. The cranio-facial region is but very slightly depressed, while the fusing of the nasal, maxillary, frontal, to a great extent the lacrymal, and finally, the premaxillary bones as seen upon this view is wonderfully complete. So much is this the case, that the only sutural traces at all evident are those of the premaxillary and of the lacrymals, and even these are very faint.

The superior mandible is very broad from side to side, and greatly compressed in the vertical direction. It gradually contracts in width as we pass forwards, up to a point about midway between the cranium and its anterior termination ; and at the same rate, it begins to widen again, to finally spread out distally into a broad spatulate extremity, which shows a slight decurvature at its tip. The anterior half of this almost unique structure is perfectly flat and in the horizontal plane, having about the uniform thickness of the blade of a table-knife. The bony external nasal apertures are well forward ; are of medium size and spindleform in outline. They stand about half a centimeter apart, with their major axes parallel to each other, and pierce directly backwards. As the floors of these openings are laid down in solid bone, and their calibres not large, we can gain through them no view of the rhinal chamber into which they lead. Starting from the anterior apex of either one, we find an indented line passing directly forwards. It sweeps round the margin of the bill within a few millimeters of its free border, to end by abruptly running out at that border at a point slightly to one side of the median one of the apex. These lines are very sharply defined.

On the lateral aspect of the skull the post-frontal process is quite rudimentary, and the squamosal one, hardly much larger, is represented by a small, sharp, inturned spinelet.

The valley of the temporal fossa between them is short but well-marked. An orbit is deep and subcircular in its general form, while the septum separating these two cavities, is entire.

The small foramen for the exit of the first pair of nerves is a short and rather broadish slit, and the nerve passes forwards in a very well defined, open groove, which leads directly into a circular foramen in the supero-mesial angle of the thickened *pars plana* of the ethmoid. The "foramen rotundum" is just of a sufficient size to pass its nerve, as is also the case with the lesser opening to its outer side. Still further externally we note in plain view, the foramen ovale. It is likewise circular in outline, and nearly equal in size to the foramen rotundum. A zygoma is short, very straight, and slender. Proximally, it makes the usual articulation with the quadrate, while distally, the maxillary portion completely fuses with the very broad nasal and the premaxillary. This latter end of the zygomatic arch is found in a much higher plane than the quadrato-jugal extremity when the skull is in the horizontal position. At its externo-inferior angle the pars plana develops an outstanding thin plate-like process that fails to quite come in contact with the *lacrymal.* This latter bone is not large, and is twisted upon itself, so that its descending plate faces forwards and backwards; while from its lower external angle a little tip is produced, which through the medium of a short rod-like and free *os uncinatum*, is extended so as to reach the maxillary bone below.

In front of these three last-named, and bounded anteriorly by the free, sharp, convex margin of the nasal, we are to observe a large, subcircular vacuity that looks into the rhinal chamber. This last is much filled in by the very extensive and fused osseous mass, made up chiefly of the swollen and spongy *maxillo-palatines.* The anterior wall of the brain-case is more than usually thick and dense, and is unperforated in any part of its extent by foramina. Posteriorly, the cranium of *Ajaja* is more than commonly rounded and smooth; the occipital ridge being but feebly pronounced, and the supraoccipital prominence not very decidedly marked. On either side of this the bone is very thin, but foramina are not seen there in thoroughly matured birds, as they are in *Plegadis* and *Guara*. *Foramen magnum* is inclined to be large, and is nearly circular in outline. Its plane makes an angle of about 45° with the base of the cranium or more. The *condyle*, of no great size, is at the same time somewhat jutting. At the base of the cranium the outstanding paroccipital processes are conspicuous, and the small basitemporal area is tilted upwards, so that its anterior apex occupies a much higher plane than its base posteriorly. The thickened sphenoidal rostrum is inclined to be triangular for its

hinder portion, so that, although the palatine ends of the pterygoids extensively articulate with each other, they are at the same time applied against the *sides* of the rostrum. In front it runs out as a spine, and the ethmoidal mass has nearly a straight anterior margin (or at the best but little concaved), which at the same time is nearly vertical. The *pterygoid* is short and curved, with its convex sharp edge presented outwardly, when articulated. These bones make the usual articulation with the *quadrates*. One of these last is a comparatively large bone for the size of the bird. Its broad orbital process has its free end truncate; its mastoidal end presents the double articulatory facet, with a feeble division drawn between them; and, as for its mandibular articulation, it is peculiar from the fact that it appears to have but one general elongated transverse facet, with an extremely shallow and faint antero-posterior line at all dividing it into two. Otherwise, the bone has the usual ornithic form, with the body somewhat compressed from before, backwards. The short *palatines* are extremely broad and are separated mesially, but by a very narrow slit. Through this latter the long, spine-like *vomer* is seen, that anchyloses with them posteriorly. Upon their under sides the palatines are flat and smooth. Behind, they meet the pterygoids, and in this part of their extent they are considerably swollen, with their outer angles completely rounded off. In front they are indistinguishably fused with the usual bones of the face and palate that they meet.

All the ordinary palatal laminæ and processes are much subordinated and inconspicuous; the main object of these bones here seeming to be to furnish a broad, osseous roof to the fore part of the mouth, and this they most emphatically accomplish. Either ear entrance is pretty well surrounded by bony walls, while the apertures to the Eustachian tubes, in front, are more or less exposed. The usual nervous and arterial foramina are found occupying their more common sites, at the skull's base, in this Roseate Spoonbill. Beyond the abrupt anterior termination of the palatines, the under side of the superior mandible is flat and rather smooth, being unpierced in any part of its extent by vacuities of any kind. There is a line-like median, longitudinal furrow, best marked posteriorly. There is a peculiar emargination to the spatulate end of this bone on its aspect now being considered. It is narrow where the mandible is narrow, and broad where it is broad. Anteriorly, it runs out before coming to the middle point upon either side, and is marked for its entire extent by a system of very delicate

linings, that are close together and take the same course as the margins of the bone itself. Somewhat fainter lines of a similar nature mark the central portion of the under surface of the spatulate end of the upper bill.

FIG. 38.

FIG. 39.

FIG. 38. Superior view of skull of *Ajaja ajaja*. Two-thirds natural size (probably a female). Drawn by the author from specimen 1505 of the Smithsonian Collection.

FIG. 39. Right lateral view of skull and detached mandible of *Ajaja ajaja*; $\frac{2}{3}$ nat. size. Drawn by the author from same specimen shown in Fig. 38.

The upper surface of the *lower jaw* is similiarly sculptured, and we will not refer to the fact again. The distal portion of this bone in the Spoonbill is dilated, horizontally flattened, lacking in either concavities or convexities, and having a form quite similar to the expanded portion of the distal third of the superior mandible. For their middle third, the mandibular rami are slender, and very much compressed in the vertical direction. On the other hand, their proximal extremities are low and transversely compressed, and no ramal vacuity is present in them. The general form of the bone may be said to be U-shaped, but this is to a great extent masked by the distal expansion. The articular ends are decidedly though gradually decurved, and their distal extremities present the usual ornithic characters. Their "cups" are deep; the inturned processes blunt; and posteriorly they are somewhat produced and hooked. In this latter particular, however, the character it not quite so pronounced as it is in the true Ibises.

Since writing the above, and upon further investigation, another skull of *A. ajaja* was discovered in the collections of the Smithsonian Institution, which upon examination was found to be a very old and incomplete one. Such characters as it exhibited agreed in all essential particulars with what has just been given above. The sternum, os furcula, and right scapula, of an adult specimen of a female *Ajaja regia* from New South Wales, Australia, was also met with in the same collection, and these bones were sufficient to show, that in this part of the skeleton at least, *Ajaja* agreed very closely indeed with the true Ibises, as *Plegadis* and its near allies. The *sternum* in this species is 4-notched and lacks a manubrium, and the *furcula* is a broad U-pattern, of a typical Ibis character, as is also the *scapula*. From this it is fair to presume, that in the matter of its *trunk skeleton*, the Spoonbill probably agrees with those birds.

Of the Limb-bones: A lot of these, numbered 1504 of the Smithsonian collection, belonged to a specimen of *Ajaja ajaja*. They consist in a skeleton of the right pectoral limb, perfect all to the pollex digit; in a skeleton of the left leg below the femur, perfect all to the last joint or two of the outer and middle toes; and finally, of an imperfect fibula and tibio-tarsus of the right pelvic limb, the proximal end having been cut away and lost.

This *humerus* has an extreme length of 13.5 cm. thus being about one-third larger than that bone as we find it in a male *Plegadis guar-*

auna. Apart from this difference in size the essential characters as found in it, the Spoonbill practically agrees with the corresponding ones as they occur in the humerus of the Ibis. This statement applies with equal truth to the bones of the *forearm*, *carpus* and *hand.* I find

FIG. 41.

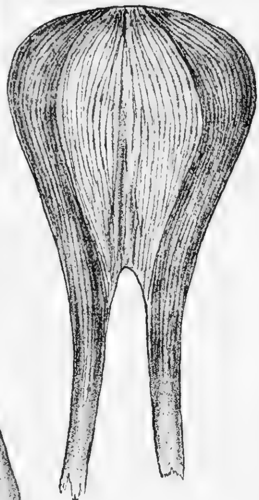


FIG. 40.

FIG. 40. Distal end of the mandible of *Ajaja ajaja*: superior surface; ½ nat. size. Probably a male.

FIG. 41. Mandible of *Ajaja ajaja.* Inferior surface; ½ nat. size. Belongs to the same skeleton from which the skull shown in Fig. 39 was taken. Both figures drawn by the author.

in *Ajaja*, however, the *ulna* to have a length of 15.7 cm., and *manus* an extreme length of 9.4 centimeters.

Passing to the bones of the *pelvic extremity*, we are at once struck by a very notable difference in these two genera, for although the salient

characters of the skeleton of these parts are truly those of the ibis in *Ajaja*, yet in the latter the *tibio-tarsus*, the *tarso-metatarsus*, and the joints of *pes* are each and all proportionately very much shorter and stouter than they are in *Plegadis*. In the case of the tibio-tarsus it has a length in the Spoonbill exceeding that bone in the ibis by but a trifle more than two centimeters; while in the case of the tarso-metatarsus there is a difference in length of but about half a centimeter in favor of *Ajaja*.

The several toe-joints in the foot of the latter are also proportionately stouter than the corresponding ones in the skeleton of pes in *Plegadis*, but they vary considerably in the matter of their several relative lengths. For example, the basal phalanx of the middle toe in *Ajaja* has an extreme length of 3.5 cm.; in *Plegadis* it measures 3.2 cm. while in the case of the second joint of the inside toe, we find they are precisely of the same length in the two species.

On the Taxonomy of this Group

From my studies of the osteology of the American and other forms representing the HERODIONES, and taking into consideration all else that has ever come to my notice upon the rest of their morphology and habits, I conceive the several groups of birds composing this suborder to have a relation to each other something after what is proposed in the subjoined scheme, viz.:

	SUPERFAMILIES.	FAMILIES.
SUBORDER. HERODIONES.	Ibidoidea	Plataleidæ. Ibididæ.
	Ciconoidea	Ciconiidæ. Scopiidæ.
	Balænicipitoidea	Balænicipidæ. Cancromidæ.
		Ardeidæ.

Taken as a whole there is hardly any question now I think, but that the Herodiones are linked with the Anseres, through the *Plataleidæ* of the present group, and the Flamingoes, of the group next to be considered. Perhaps *Ajaja ajaja* is the species among the American *Ibidoidea* most nearly related to *Phœnicopterus ruber*. Many other avian taxonomers of the first rank likewise claim that the Herodiones are in some way linked with the *Accipitres* or even with the *Steganopodes*, with the first by the Storks leading through the Secretary Bird, and with the latter in some strange way with the Tropic Birds or even the Frigate Birds. To me, the first-named affinity may be

probable, but I am somewhat sceptical in regard to it; in any event far more extensive anatomical comparisons are necessary between the representatives of those two groups, than have as yet been made in their case.

That the *Plataleidæ* and the *Ibididæ* are two distinct families, I have no manner of doubt. For although it is likely that *Ajaja* possesses a skeleton, apart from the skull, that is in all essential particulars that of ibis, it differs, nevertheless, osteologically very materially in the characters of the excepted part, from the corresponding characters in the skull of any true ibis. And, to say the least of it, *Ajaja* is essentially a holorhinal bird, while all the true Ibises are strongly schizorhinal.[1]

Of the three American superfamilies composing the Herodiones, perhaps the most thoroughly distinct group is seen in the *Ardeidæ;* in other words the gap existing between the Herons and Storks, or, between the Herons and the Ibises, is decidedly more evident than is the gap existing between the Storks and the Ibises; indeed the typical Ciconoidea are probably linked with the *Ibididæ* through the genus *Tantalus*.

As for the relations of the Herons and Bitterns to each other, nothing more need be said here beyond what I have already pointed out in my remarks closing the osteology of the family *Ardeidæ*, given above.

EXPLANATION OF PLATES.

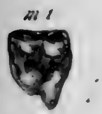
PLATE V.

Skeleton of an Ibis (*Plegadis fal inellus*): Coll. U. S. National Museum, No. 14,406. (Reduced.)

PLATE VI.

Left lateral view of the skull of the "Wood Ibis" (*Tantalus loculator*). Reuced. From a photograph by the author. (Specimen No. 1,508: Coll. U. S. National Museum.)

[1] I am aware when I make this statement, that Garrod placed both *Ibis* and *Platalea* among his schizorhinal birds, but the latter is a long ways from being typically so, and besides *Ajaja* has a good many other characters in its skull quite unlike the comparable ones in the skull of a true Ibis. These characters have been set forth in detail above.


m 1

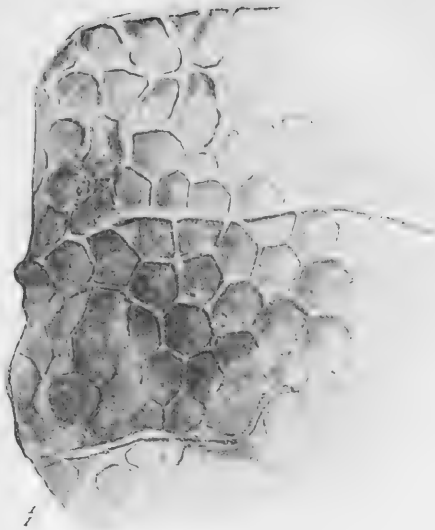
7.


3/1

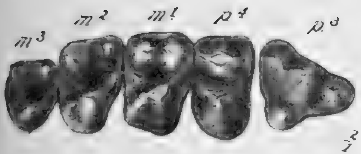
6.


3/1

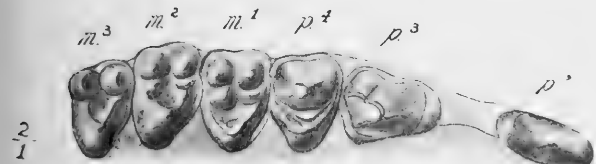
5.


1/1

8.


m 3
m 2
m 1
p 4
p 3
2/1

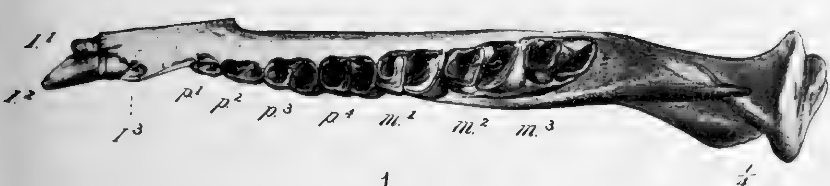
3.


m. 3
m. 2
m. 1
p. 4
p. 3
p'
2/1

4.


1/4

2.


I. 1
I. 2
I 3
p 1
p 2
p. 3
p. 4
m. 1
m. 2
m. 3
1/4

1.

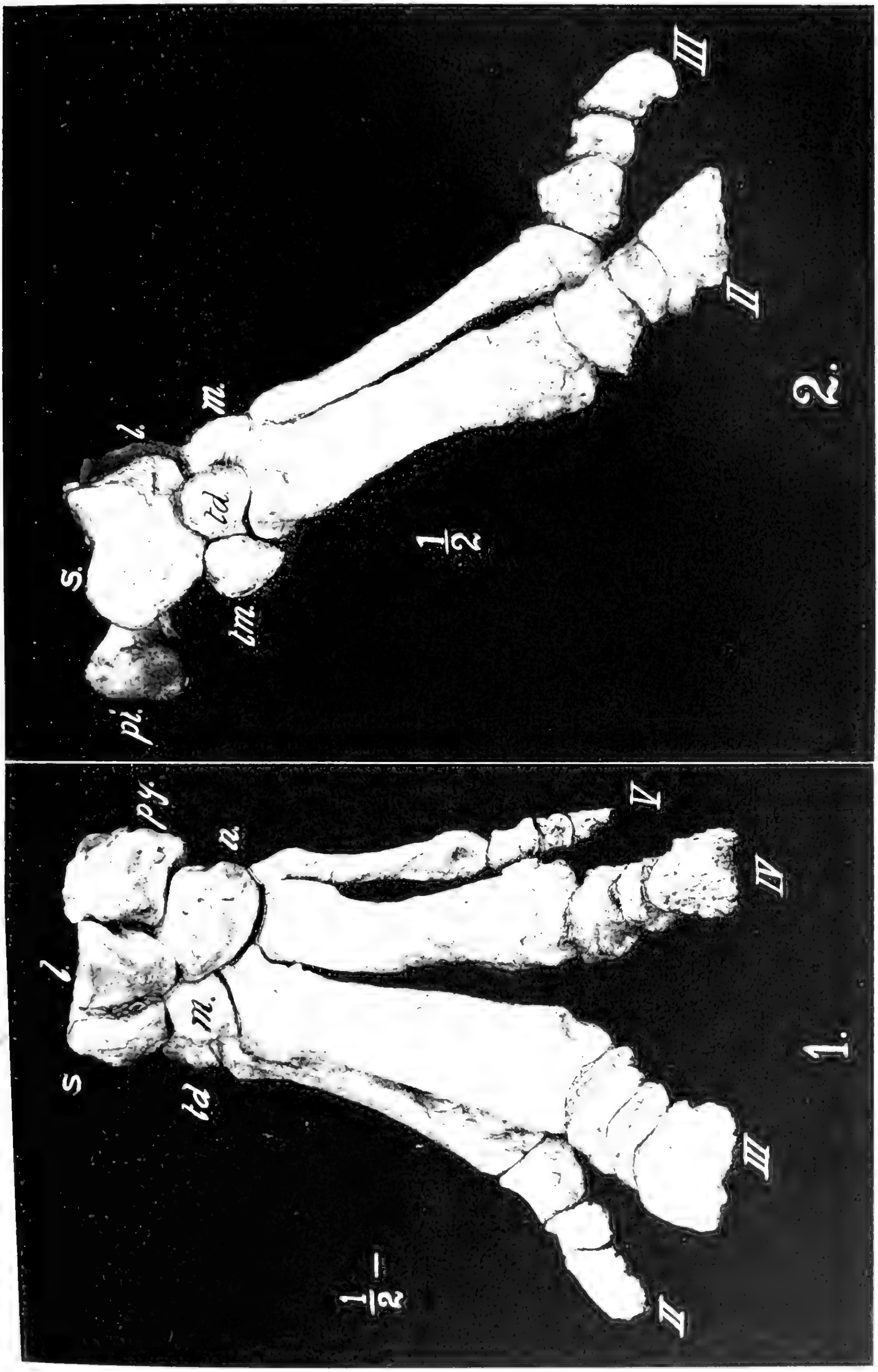
1/2

2.

1/4

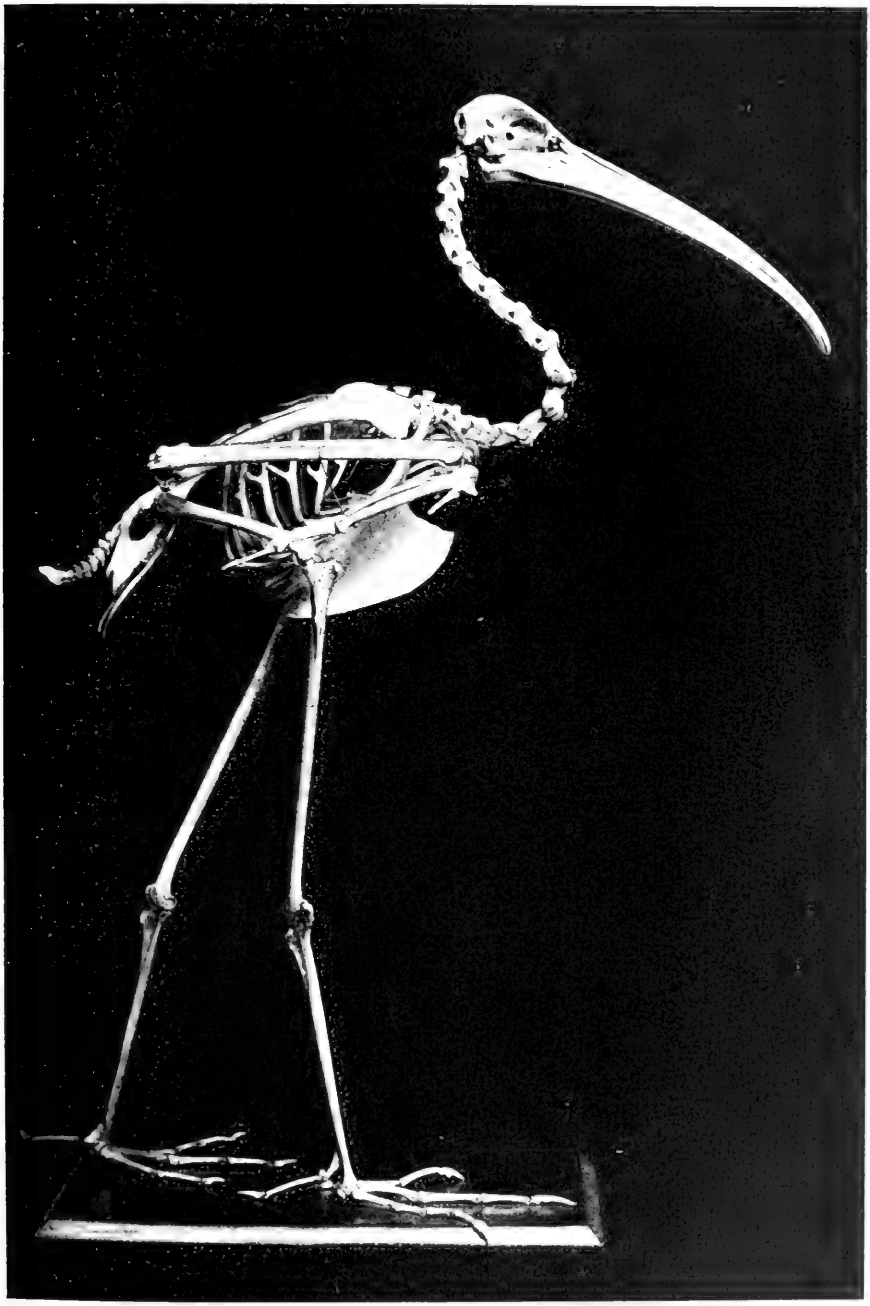
1.

Trigonias Osborni Lucas.



s.
l.
m.
td.
tm.
pi.
III
II
1/2
2.
s
l
py.
u.
m.
td.
V
IV
III
II
1/2
1.

Trigonias Osborni Lucas.



S. . . . . F .

Left Lateral View of Skull of Wood Ibis (Tantalus loculator)

ANNALS

OF THE

CARNEGIE MUSEUM

VOLUME I. NO. 2.

Editorial.

The appearance of the first part of the first volume of the Annals of this Museum has led to the receipt of many letters of congratulation from eminent scientific men and to grateful words of commendation from those who are concerned with the administration of the affairs of kindred institutions. That the undertaking to which we have addressed ourselves in giving to the world from time to time the results of the scientific investigations of the staff of the Museum and those who are associated with them must tend to promote the reputation and usefulness of the Museum, does not admit of doubt. In this connection it is proper to call attention to the very complete and instructive Memoir upon the osteology of Diplodocus, from the pen of Prof. J. B. Hatcher, which was published in July. This Memoir is the first part of the first volume of the *Memoirs* of the Museum and embodies all that is definitely known in reference to this colossal quadruped. It has been gratifying to the authorities of the Museum to be able so early in the life of the institution to communicate to the world of science so complete and exhaustive a treatise upon a subject the study of which is surrounded by many inherent difficulties.

The good work begun will be continued, and with the material already in hand, and which is certain to be acquired as the months pass by, we feel confident that the publications of this institution will come to be recognized as of permanent value.

Inasmuch as one of the functions of this Museum is the development of the spirit of research in the field of local history and archæology, as well as in the domain of natural history, it has been determined to include in the ANNALS from time to time papers treating of the early history of western Pennsylvania, and more particularly to make the ANNALS the medium for the publication of documents which may be regarded as "sources" of historical information. The present volume will therefore contain a paper embodying the records of "The Province of West Augusta," with a historical introduction from the pen of the Hon. Boyd Crumrine, whose familiarity with the early history of the region is well known. This paper will be followed in later issues by the publication of the records of the courts held under the authority of the Colony of Virginia in what was known as Yohogania County, which covered southwestern Pennsylvania. These records throw much light upon questions of a historical and genealogical nature. Their existence has been known to but few, and their publication is timely and important from a historical standpoint.

MUSEUM NOTES.

(When not signed the Editor is responsible for these notes.)

Exotic Mollusca in the Phipps Conservatory, Schenley Park, Pittsburgh.—The following species of exotic Mollusca have been found to date. In order to show how widely some species have been distributed, by means of plant exchanges, the original habitat is given in brackets.

Opeas johannina Morelet. (Anjouan, or Johanna Island, of the Comoro group.)

Opeas goodalli Miller. (West Indies, but originally described from examples found in an English greenhouse.)

Vitrea draparnaldi Beck. (Europe.)

Limax maximus Linn., and several of its color varieties. (Europe.)

Amalia gagates Drap. (Europe. This may be identical with *Amalia hewstoni* Coop. of the western coast of America, in which case it is a circumpolar species.)

Arion hortensis Fer. (Europe.)

So far as is known the only species which has spread outside of the greenhouse is *Limax maximus*, it having been found in the East End in gardens.

GEO. H. CLAPP.

Protective Coloration in Cambarus virilis Hagen.—In Mr. E. B. Williamson's paper on "The Crayfish of Allegheny County, Pa.," ANNALS Carnegie Museum, Vol. I, No. 1, p. 8, mention is made of *C. virilis* Hagen from Ontario, Canada. These crayfish were collected by me in Sandy Lake, a small lake in Peterborough County, between Pigeon and Buckthorn Lakes, in 1894 and 1895. The bottom of the lake is made up entirely of white marl and clay, and, as normally colored crayfish would be very conspicuous, those found in this lake have adapted themselves to their surroundings, and the color varies from almost pure white to pink, or in some cases to a delicate greenish tint. Their color makes them practically invisible when at rest, so that they are difficult to capture. The fishermen of the district have found that this protective coloration makes them very conspicuous in other places, so that large numbers of them are gathered every year and taken over to the other lakes to be used in bass fishing.

Local fishermen claim that "the black bass is *white* in Sandy Lake," and the single specimen which I saw caught was of almost a silvery-white color; entirely different from those of lakes less than three-quarters of a mile away.

The character of the water may have something to do with the color, as it appears to be very strongly impregnated with lime and other salts. Plants growing in the lake are heavily incrusted and when taken out of the water and dried become so brittle that they break at a touch.

In contrast to the pale colors of the fish and crayfish I may state that the most richly colored examples of *Unio luteolus*, var. *rosaceus* De Kay, which I have ever seen, I collected in this lake.

GEO. H. CLAPP.

Bipalium kewense Mos.—This "Land Planarian," described by Prof. H. N. Moseley from specimens found in Kew Gardens, imported on plants from some unknown district, has since been found in greenhouses in many parts of the world. (See "Notes on Turbellaria," by Prof. W. McM. Woodworth, in Am. Naturalist, Vol. XXX., p. 1046.) It has also been found in the forests of Upolu, Samoa.

In January, '94, I found a single young example in the Phipps Conservatory, Allegheny, and in the fall of '97 several young and one

adult, about 200 mm. long, in the Schenley Park Conservatory, where it appears, from statements made by the workmen, to be fairly common.

GEO. H. CLAPP.

EARLY in May, Mr. W. E. C. Todd, Dr. D. A. Atkinson, and Mr. George Mellor, representing the Museum, were sent on an expedition to northeastern America for the purpose of collecting birds and other objects of interest for the Museum. After spending some time in the province of New Brunswick they repaired to the Magdalen Islands and to Bird Rock, in the St. Lawrence, where extensive collections of sea-fowl were made. They thence proceeded to Newfoundland, and, after spending some time in collection in that island, they went to Labrador. On going to press they still are at Nain, on the Labrador coast, where they are busily at work.

THE work of exploring the fossil fields of the West has been carried on during the past summer with great vigor under the direction of Mr. J. B. Hatcher. The party employed at Cañon City under the immediate charge of Mr. W. H. Utterback, has been very successful in recovering a large amount of valuable material from the quarry long successfully worked by the late Prof. O. C. Marsh. The Museum has acquired title to eighty acres of land lying north of this locality, on which Professor Cope at one time labored very successfully and from which he recovered a great many specimens. Instructions have been given by Mr. Hatcher to thoroughly open up the deposits on this ground, and from present appearances the Museum will be greatly enriched. The deposits abound in fossils in an admirable state of preservation and Professor Cope's work, though extensive, has left scarcely any impression upon the beds, which it is now intended to thoroughly explore. No better location in all the region of the Rocky Mountains could be found in which to work out the phylogeny of the the dinosaurs of the Jurassic deposits. Almost all the horizons in which these great vertebrates occur are here found, and in every horizon there are exposed to view skeletons which it will be possible for the Museum to secure. The work at Sheep Creek, in Wyoming, under the care of Mr. Gilmore, has also progressed very satisfactorily. Mr. Gilmore reports himself as having secured the greater portion of the skeleton of a large specimen of Brontosaurus.

Mr. Peterson has completed his work of the summer in the vicinity of Harrison, Nebraska, and reports phenomenal success. Altogether the work of the Museum in the Department of Paleontology during the summer of 1901 appears likely to prove memorable in the history of the institution.

THROUGH the kindness of Mr. Carnegie the Museum has received one of five ancient boats which were discovered a few years ago at Dhakshur, about twenty miles above Cairo and about two miles from the present course of the river Nile. One of these boats was obtained a year or two ago by the Field Columbian Museum in Chicago. The specimen received by the Museum appears to be in excellent condition in view of its age—4,500 years. It is over thirty feet in length, seven feet in beam, and about five feet deep. At present there is no space in the exhibition halls sufficiently large to admit of its exhibition, and it will be stored until such time as the new exhibition halls are completed. Permission has kindly been accorded by Mr. E. M. Bigelow to erect a temporary structure in the Park in which it will be housed.

VI. ON THE CRANIAL ELEMENTS AND THE DECIDUOUS AND PERMANENT DENTITIONS OF TITANOTHERIUM.

By J. B. Hatcher.

Among other material collected by the Carnegie Museum Paleontological Expedition of 1900 there is a skull and considerable portions of the skeleton (No. 116) of a young Titanothere. This was found near the base of the Titanotherium beds about three miles north of the Brewster and Emmons ranch on Warbonnet Creek, in Sioux Co., Nebraska. The skull and lower jaw are of especial interest, since, owing to the immature age of the individual, most of the cranial sutures are still open, making it possible to determine the character of the different bones. Moreover the milk dentition is still preserved, so that it is possible to determine its nature, while the permanent dentition is sufficiently advanced to indicate definitely the method and order of replacement of the deciduous by the permanent teeth.

The Skull.

When viewed from above the frontals are much the more conspicuous elements. They are bluntly rounded posteriorly and are projected far backward beneath and between the lateral anterior projections of the parietals. Anteriorly the frontals are continued into two long lateral projections which extend beyond the orbits, overlie the posterior and lateral margins of the nasals and give rise to the pair of horn cores that form such characteristic features in the Titanotheridæ. The nasals are arched superiorly, concave inferiorly, with rather long posterior extensions interposed between the frontal horns. In the present specimen the nasals are very thin along their inner margins but much thickened externally and posteriorly, where they give the chief support to the horns. They are slightly shorter than the premaxillaries and somewhat emarginate anteriorly.

The parietals are not so broad as the frontals. They are deeply emarginate anteriorly and posteriorly, where they are separated by the interparietal portion of the supraoccipital much as in Equus. From the

above description it will be seen that the anterior border of the parietals overlies and encloses laterally the posterior border of the frontals, while the anterior border of the latter has a like articulation with the nasals, the relative position of these bones being similar to that of the shingles of a roof.

The zygomata are rather broadly expanded and are composed about equally of the malars and squamosals.

When seen from the side the skull appears somewhat low, with an abbreviated facial region and a rather long posterior portion. The occipital crest and anterior frontal regions are each somewhat elevated. The nasals appear rather deep and send down an inferior and posterior projection, which articulates by suture with the superior border of the maxillary. The infraorbital foramen lies wholly within the maxillary. The maxillonasal suture is opposite the middle of the orbit. The lachrymal is rather large. The malar is long and thin, anteriorly it has an extended contact with the maxillary and posteriorly with the squamosal portion of the zygoma. The squamosal rises high above the external auditory opening and overlaps the side of the parietal

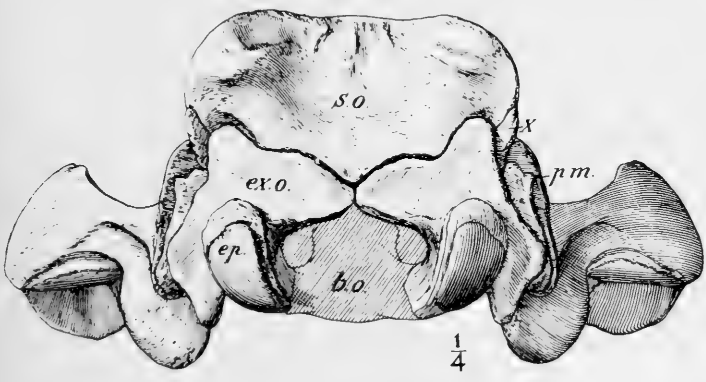


FIG. 1. Posterior view of skull of young Titanothere, one-fourth natural size, No. 116. *SO.*, supraoccipital; *ex.o*, exoccipital; *b.o*, basioccipital; *ep.*, epiphyses of occipital condyle; *p.m.*, paramastoid; *x.*, superior free portion of paramastoid.

throughout most of its length. There is a long, thin, transversely expanded postglenoid process and a shorter and proportionately stronger posttympanic process of the squamosal. The tympanic is absent, having been lost from the present specimen. The periotic is

present and its paramastoid portion appears externally between the posttympanic and paroccipital processes. Just above this there is another small bone which is continued into a long pointed process inserted between the exoccipital and the squamosal and parietal; it probably became coössified later with the periotic, but in the present specimen it is seen as a separate bone, as shown in Fig. 1 and in plate VII. The exoccipitals are rather large and support the paroccipital processes and the occipital condyles. The latter are ossified from two distinct centers, the articular portions bearing distinct epiphyses, as shown in the accompanying figures.

Seen from behind the occiput is low and broad. The condyles are widely separated by the foramen magnum, which is much broader than deep. The condyles are entirely supported by the exoccipitals, which rise and meet in the middle line above the foramen magnum, entirely excluding the supraoccipital from any part in the formation of the superior border of that opening. The supraoccipital is very broad and low. The occipital crest is nearly flat above, but broadly emarginate posteriorly. (See Fig. 1 of the text, and plate VIII.)

Inferiorly the palate is seen to be formed anteriorly by the very short premaxillaries, for the most part broken away in the present specimen, and by the maxillaries, between the posterior lateral extremities of which are inserted the palatines. These form the posterior median portion of the roof of the palate and send backward on either side a lateral projection along the inner sides of the maxillaries and pterygoids, which are continued nearly to the posterior end of the basisphenoid.

The vomers are continued far back as a thin plate resting upon the pre- and basisphenoids and sending downward a thin, knife-like median bony septum. The basisphenoid in the present specimen is entirely free from the basioccipital, the suture being open, and the basioccipital had dropped out and was lost before the specimen was found. The absence of the basisphenoid and tympanic bones makes it impossible to describe and locate the various foramina of this region of the skull.

THE TEETH.

The present specimen is of especial interest in that both the inferior and superior deciduous and permanent dentitions are shown essentially complete.

DECIDUOUS TEETH.

Deciduous dental formula I. $\frac{2}{2}$, C. $\frac{1}{1}$, M. $\frac{4}{4}$ = 28.

Superior deciduous dentition: Deciduous i.$\frac{1}{}$ is slightly smaller than d. i.$\frac{2}{}$. Both are very small in the present specimen and on the point of dropping out, though their successors have not yet appeared. The canines have not yet pierced the gums, though their crowns are well formed. They are slightly compressed laterally and exhibit distinctly crenulated and rather sharp anterior and posterior margins. Deciduous m.$\frac{1}{}$ is a small tooth fixed in the jaw by two roots, one anterior, the other posterior. The latter is much the stronger of the two. There are two external cusps and one internal cusp. The tooth has been some time erupted and its crown is much worn, but still shows in the middle a small enamel-covered pit, a remnant of a median sinus. Deciduous m.$\frac{2}{}$ is a rather large tooth but not entirely molariform. The crown is entirely worn away, not a remnant of its structure being preserved. There are two distinct external cones and the small remnant of enamel remaining on the inner border of this tooth exhibits a faint inflection near the middle, indicative of a tendency on the part of this tooth toward the true molariform pattern.

Deciduous m.$\frac{3}{}$ is entirely molariform with two distinct external and internal cones. The structure of the crown of this tooth is likewise much obliterated by wear, though not so much as in the preceding tooth. There still persists on the anterior surface a very small enameled pit as a remnant of the anterior valley.

Deciduous m.$\frac{4}{}$ is the largest tooth of the deciduous series. It is less worn than any of the preceding molars. It is quite molariform and is provided with an external basal cingulum, which character is only faintly, or not at all, developed on the preceding teeth.

Inferior deciduous dentition: The deciduous lower incisors are wanting in the present specimen, having doubtless been shed, or lost, prior to the death of the animal. The alveoles are still faintly discernible. In a second and younger specimen, No. 117, from the same locality, there are two incisors on either side. These have extremely large crowns, are just in process of eruption, and entirely fill the alveolar margin of the premaxillaries between the unerupted canines. Deciduous i.$\frac{}{2}$ is larger and more advanced than is d. i.$\frac{}{1}$. The canines are in about the same stage as are the superior canines and they do not differ materially from the latter. Deciduous m.$\frac{}{1}$ is a small trenchant tooth

fixed in the jaw by only one root. The crown is composed of two cusps, one anterior, the other posterior. The anterior is the larger of the two. This tooth exhibits only faint traces of wear, and its eruption must have been somewhat subsequent to that of d. m.$\frac{1}{\ }$. Deciduous m.$\frac{\ }{2}$ is quite molariform, has a very long crown and was fixed in the jaw by two widely separated roots, one anterior and the other posterior. The crown is much worn and anteriorly it is produced somewhat beyond the anterior cusps and forms an additional anterior grinding surface, not seen in the succeeding lower milk molars, nor in the replacing permanent teeth. It was this portion of this tooth that in life was opposed to d. m.$\frac{1}{\ }$ and accomplished the erosion already noticed on the crown of that tooth. Deciduous m.$\frac{\ }{3}$ is only a little less worn than the preceding tooth and is strictly molariform. Deciduous m.$\frac{\ }{4}$ is much larger and less worn than are the preceding teeth. It is in form like permanent molars $\frac{\ }{1}$ and $\frac{\ }{2}$ and has not the third lobe seen in the last lower molar of all the Titanotheres. The absence of this lobe in this tooth is somewhat remarkable and would seem to form an exception to the general rule *that the last deciduous lower molar in the ungulates has the form of the last permanent lower molar, rather than that of the fourth premolar, which replaces it.* In the present instance this tooth is like the fourth premolar and ms.$\frac{\ }{1}$ and $\frac{\ }{2}$, and this rule would seem to hold good in the genus Titanotherium, for I have recently examined a number of other jaws of young Titanotheres and find in each instance the same conditions.

THE PERMANENT DENTITION.

Of the permanent dentition in the skull under discussion only ms.$\frac{1}{1}$ are erupted and in position. These teeth are in either instance slightly worn, while ms.$\frac{2}{2}$ are already formed and in position ready for eruption. But ms.$\frac{3}{3}$ are only just commencing to form. The cusps are partially developed, but in each instance they are separated, not having assumed their proper positions in the jaw. Each cusp seems to be developing independently of the others and from different centers, much as certain bones ossify from different centers, which later become connected and form a single bone or tooth as the case may be. In the lower jaw the molars are first formed high up in the ascending ramus just beneath the condyle and base of the coronoid process. From this position, as the jaw lengthens with the growth of the animal, the tooth moves downward and the crown assumes a ver-

tical position, ready for eruption at the posterior end of the horizontal ramus. In this manner ms.$\frac{}{2}$ and $\frac{}{3}$ successively occupy similar positions in the ascending ramus. In the present specimen the outer surface of the maxillary and lower jaw have been removed, revealing pms.$\frac{2}{2}$, $\frac{3}{3}$ and $\frac{4}{4}$ in their respective positions. Of these teeth pms.$\frac{2}{2}$ and $\frac{3}{3}$ are the more advanced and in each instance they appear in the act of replacing their respective milk molars. Pms.$\frac{4}{4}$ are not nearly so advanced as the two preceding teeth and appear far below and between the roots of the fourth milk molars, which teeth they will later replace. A somewhat careful examination has failed to reveal any trace of the permanent incisors, canines or first premolars. It is presumable that these teeth will all appear somewhat later, when this region of the skull has been sufficiently elongated to accommodate them.

METHOD AND ORDER IN THE APPEARANCE OF THE DECIDUOUS TEETH AND IN THEIR REPLACEMENT BY THE PERMANENT DENTITION.

A careful study of the comparative degrees of wear shown by the deciduous teeth in Nos. 116 and 117 of our collections shows that they made their appearance in the following order, d.m.$\frac{2}{2}$, $\frac{3}{3}$, $\frac{1}{}$, $\frac{4}{4}$, $\frac{}{1}$, d.i.$\frac{2}{2}$, $\frac{1}{1}$, d.c.$\frac{1}{1}$. The canines were just cutting the gums when d.ms.$\frac{2}{2}$ and $\frac{3}{3}$ were ready to drop out.

Of the permanent teeth the superior and inferior first molars were the first to appear, followed a little later by pms.$\frac{2}{2}$ and $\frac{3}{3}$. The next to cut the gums would be ms.$\frac{2}{2}$, which would appear shortly after the second and third premolars. Then, after a considerable interval, pms. $\frac{4}{4}$ would replace deciduous molars $\frac{4}{4}$, and these would be shortly followed, as the jaws increased in length, by molars $\frac{3}{3}$, while the permanent canines and incisors would be the last to appear, but in what order is not determinable from the material at hand.

All the dental and cranial characters above mentioned are well shown in the accompanying illustrations, which have been made from drawings by Mr. Rudolph Weber.

No. 116 has been freed from the matrix and very skillfully mounted as a disarticulated skull by Mr. A. S. Coggeshall, a feat rarely possible in fossil skulls, more especially when they are from so old a formation as the Oligocene.

EXPLANATION OF PLATES.

PLATE VII.

Skull of young Titanothere (No. 116) seen from left side, one fourth natural size, na, nasal; fr, frontal; la, lachrymal; mx, maxillary; pmx, premaxillary; ma. malar; sq, squamosal; pa, parietal; x, free portion of paramastoid; ep, epiphysis of condyle; po, paroccipital process; pm, paramastoid; pt, posttympanic process; pg, postglenoid process. Deciduous and permanent dentitions indicated by the usual symbols.

PLATE VIII.

Superior view of same skull (No. 116) one fourth natural size. iof, infraorbital foramen; ip, interparietal process of supraoccipitals; so, supraoccipitals. Other letters as in Plate VII.

VII. SABAL RIGIDA; A NEW SPECIES OF PALM FROM THE LARAMIE.

By J. B. Hatcher.

Thus far no palms have been reported from the Laramie, though their remains are abundant in some of the earlier Mesozoic strata and they have been found, though less abundantly, in the Green River shales and earlier Tertiary deposits of our Western States.

During the seasons of 1889 to 1892, while the writer was engaged in bringing together a collection of Horned Dinosaurs (*Ceratopsia*) from the Laramie deposits, for the late Professor Marsh, a number of beautifully preserved trunks of palms were secured. Unfortunately no notice of these has ever been published.

While engaged in making a collection of fossil vertebrates from the same deposits in the Ceratops beds of the Laramie of Converse County, Wyoming, during the season of 1900, the writer was fortunate in securing a portion of the leaf of a large fan-leaf palm. The specimen, No. 1, of the Carnegie Museum collection of fossil plants, consists of only a portion of a single leaf. The fragment has an area of about one square foot. It was found in the upper Ceratops beds on the west side of Doegie Creek and about five miles above its mouth, in Converse Co., Wyoming. It was imbedded in a much shattered block of Laramie sandstone and a considerable portion of it had already weathered away when found. The portion preserved is in a splendid state of preservation and a fragment of it is shown here in Fig. 1, which is about one-sixth natural size. The leaf was when entire of considerable dimensions, two feet or more in diameter. Unfortunately the base and petiole are wanting. The ribs are well preserved and stand out in relief on the surface of the sandstone, showing that they were sufficiently rigid to retain their normal positions while being imbedded in the sands by which they were preserved. It is with reference to the rigid nature of the leaf that the specific name has been given.

The nature of this leaf and of the palm trunks above referred to coming from the same deposits would seem to indicate that *Sabal*

rigida was a rather tall and graceful palmetto, much resembling in general appearance *S. palmetto* of our Southeastern States. The ribs were numerous and about one-half of an inch in breadth. The imperfect nature of the specimen does not permit of a definite determi-

FIG. 1. Portion of leaf of *Sabal rigida* Hatcher. One-sixth natural size.

nation of its generic or specific characters. There can be little doubt however, that it pertains to the genus Sabal. Its importance is chiefly due to the fact that it affords conclusive evidence that palms existed in the Laramie and thus points to a mild, subtropical climate for our western plains region, throughout that period. Climatic conditions quite compatible with, if not absolutely necessary for, the the maintenance of the exceedingly rich Dinosaurian fauna that is known to have inhabited this region in Laramie times.

VIII. SUPPLEMENT TO DR. JOHN HAMILTON'S LIST OF THE COLEOPTERA OF SOUTHWESTERN PENNSYLVANIA.

By Henry G. Klages,[1] Jeannette, Pa.

Seven years have elapsed since the publication of Dr. John Hamilton's List of the Coleoptera of Southwestern Pennsylvania,[2] and during these years many species have occurred here, which were not noted at the time of that publication. The most of these have been collected in the vicinity of Jeannette, and in the mountainous region near St. Vincent's Abbey. The species taken in the latter place have been collected by Rev. P. Jerome Schmitt, O.S.B., and his able assistants, Rev. P. Marcellus Rettger, O.S.B., and Rev. P. Richard Kraus, O.S.B. Some of the species recorded in the former list have not been taken here for many years; while others not recorded, or considered rare, are now commonly found.

That all the species on this list ought to be regarded in a strict sense as local species, I cannot say, as, in many cases, only a single specimen has been obtained, which might, indeed, have been introduced in one or the other of several ways. Insects may, perhaps, be introduced by the wind-storms, which sweep the Ohio valley, and also by trains (as the passenger-coaches of night-trains, on arriving at Pittsburgh during the summer months, are frequently found to contain hundreds of insects). Food supplies, such as tropical and dried fruit and imported nuts, often introduce species, which in some cases are perpetuated.

The region in which most of these species were collected is hilly and mountainous, and lies at a considerably higher altitude than the environs of Allegheny where most of Dr. Hamilton's collecting was done. Many of the species are monticolous, and years of careful collecting in the country near St. Vincent's Abbey have added many species new to science, and have largely increased our local list of insects.

[1] The lists of the Scydmænidæ and Pselaphidæ, together with the notes on these families, are from the pen of Rev. Jerome Schmitt, O.S.B., of St. Vincent's Abbey.

[2] Transactions of the American Entomological Society, Vol. XXI, pp. 1–36, Jan., 1894.

There are here given three hundred and eighty-eight species and twenty-six varieties. Of these, three hundred and sixty are determined, and twenty-eight are undetermined. The total number of species of beetles found up to this time in southwestern Pennsylvania is over twenty-five hundred.

As far as possible I have adopted the genera of Henshaw's Catalogue, except in the case of the families Scydmænidæ and Pselaphidæ. As these families have been completely revised, and many new genera created, the change of generic names has been considered necessary. No new family of Coleoptera is added to our fauna by this list except the Stylopidæ.

I am especially indebted to Rev. J. Schmitt of St. Vincent's College for permission to incorporate his list and notes on the Scydmænidæ and Pselaphidæ, which will be appreciated by coleopterists everywhere. To the Director of the Carnegie Museum, Dr. W. J. Holland, I tender my thanks for his courtesy in aiding me in many ways, and also to the coleopterists of Pittsburgh and vicinity, for the privilege of examining their collections.

§ Denotes species listed in manuscript by Dr. John Hamilton since the publication of his list.

* Denotes species collected near St. Vincent's by Rev. Jerome Schmitt and his assistants.

Species collected by others, I note in my remarks on the species.

Note. - Dr. John Hamilton by his last will and testament bequeathed his collection of Coleoptera, together with his library relating to Coleoptera, and his manuscripts, to Dr. W. J. Holland, in trust, to be by the latter placed in such institution as might appear to be the most suitable and best repository for the same, expressing a preference to have the collection placed in a museum connected with the Carnegie Library in Pittsburgh, should such a museum be established, and proper provision made therein for the preservation of scientific collections. Dr. Holland after Dr. Hamilton's death turned over the collection and the books and manuscripts to the Trustees of the Carnegie Institute. It is by the special permission of Dr. Holland that I am able to incorporate in this supplementary list the names of those species which Dr. Hamilton recorded in his manuscripts as having been found by him since his list went through the press. I desire to express with deep gratitude my indebtedness to Dr. Hamilton for the assistance and encouragement I received from him during his life-time. I owe to him the fact that I am able to "contribute my mite" to the science of entomology. When sixteen years ago I began to form a collection, he aided me by giving me most valuable hints and suggestions, and from year to year determined my specimens for me. In his death entomology has lost one of its most valued students, and beginners one of their most patient helpers.

ADDITIONS TO HAMILTON'S LIST OF THE COLEOPTERA OF SOUTHWESTERN PENNSYLVANIA.

CICINDELIDÆ.

Cicindela purpurea
var. **limbalis** *Kl.*
Cicindela marginipennis *Dej.*
rufiventris *Dej.*

CARABIDÆ.

Cychrus stenostomus *Web.*
Scarites subterraneus var. **substriatus** *Hald.*
Clivina dentipes *Dej.*
Aspidoglossa subangulata *Chd.*
Ardistomis puncticollis *Putz.*
* **Nomius pygmæus** *Dej.*
* **Tachys ferrugineus** *Dej.*
Pterostichus permundus *Say.*
pennsylvanicus *Lec.*
Evarthrus americanus *Dej.*
§ **heros** *Say.*
§ **furtivus** *Lec.*
§ **Loxandrus rectus** *Say.*
minor *Chd.*
Diplochila impressicollis *Dej.*
Dicælus carinatus *Dej.*
Platynus larvalis *Lec.*
errans *Say.*
rubripes *Zimm.*
Galerita decipiens *Horn.*
Lebia tricolor *Say.*
§ **pulchella** *Dej.*
ornata var. **axillaris** *Dej.*
collaris *Dej.*
Callida purpurea *Say.*
Brachynus fumans *Fab.*
Chlænius solitarius *Say.*
Agonoderus testaceus *Dej.*
Anisodactylus verticalis *Lec.*

DYTISCIDÆ.

Ilybius ater *DeG.*
Dysticus hybridus *Aubé.*
Acilius mediatus *Say.*
Thermonectes ornaticollis *Aubé.*

HYDROPHILIDÆ.

Helophorus granularis *Mots.*
tuberculatus *Gyll.*
Limnebius piceus *Horn.*
Philhydrus perplexus *Lec.*
Cymbiodyta rotundatus *Say.*
Sphæridium scarabæoides *Linn.*

SCYDMÆNIDÆ.

Since the publication of Hamilton's List this family of micro-coleoptera has been studied by Capt. Thomas L. Casey, U. S. Army, who is known to entomologists as one of the most experienced and careful students of minute coleoptera. His excellent work on the Scydmænidæ is far in advance of anything heretofore published on the subject. So

many errors occurred in the determination of these insects prior to the publication of Capt. Casey's monograph of the Scydmænidæ, and so many new species have been added to our fauna, that it has been thought advisable to republish the whole list of our species. To Rev. P. Jerome Schmitt of St. Vincent's College, who has spent years of study on the Scydmænidæ and Pselaphidæ, and through whose systematic collecting many new species of these remarkable coleoptera have been discovered, I am indebted for the list and the notes on the same, which are here given, and for the preparation of which credit is due him. The species listed are all, with few exceptions, in the collection at St. Vincent's College, and all occur in southwestern Pennsylvania.

SCYDMÆNIDÆ.

Euconnus clavipes *Say.*
bicolor *Lec.*
cavipennis *Casey.*
occultus *Casey.*
affinis *Casey.*
species near **debilis** *Casey.*
Pycnophus rasus *Lec.*
Connophron oreophilum *Casey.*
fossiger *Lec.*
clavicorne *Casey.*
luteipes *Casey.*
comptum *Casey.*
pallidum *Casey.*
decorum *Casey.*
testaceipes *Casey.*
castaneum *Casey.*
triviale *Casey.*
parcum *Casey.*
biceps *Casey.*
caviceps *Casey.*
trinifer *Casey.*
fulvum *Lec.*
bifidum *Casey.*
mutilans *Casey.*
capillosulum *Lec.*
Connophron longipilosum *Casey.*
lacunosum *Casey.*
pallidipes *Casey.*
Scydmænus perforatus *Schaum.*
badius *Casey.*
turbatus *Casey.*
species near **puncticeps** *Casey.*
pubipennis *Casey.*
corpusculum *Casey.*
caducus *Casey.*
Opresus luteus *Casey.*
atomus *Casey.*
Delius robustulus *Casey.*
Neladius tenuis *Casey.*
Cephennium corporosum *Lec.*
Ascydmus tener *Casey.*
Eutheia americana *Casey.*
Veraphis capitata *Casey.*
cristata *Brend.*
New species.
Leptoscymnus caseyi *Brend.*
cavifrons *Casey.*
Eumicrus motschulskii *Lec.*
Acholerops zimmermanni *Schaum.*
retrusa *Casey.*

PSELAPHIDÆ.

So many new species have been found to belong to our local fauna, that it has been thought advisable to rewrite the entire list of our species, for which, as in the case of the preceding family, I am indebted to Rev. Jerome Schmitt.

Rafonus tolulæ *Lec.*
Rexius insculptus *Lec.*
  canaliculatus *Lec.*
  trogasteroides *Brend.*
Ramecia crinita *Brend.*
  dentiventris *Casey.*
  arcuata *Lec.*
Pycnoplectus tenellus *Casey.*
  interruptus *Lec.*
  3 species near **interruptus** *Lec.*
Euplectus longicollis *Casey.*
  confluens *Lec.*
  elongatus *Brend.*
  new species near **elongatus** *Brend.*
  iowaensis *Casey.*
  pertenuis *Casey.*
Thesiastes fossulatus *Brend.*
Bibloplectus rufipes *Lec.*
  leviceps *Casey.*
Entyphlus similis *Lec.*
Thesium cavifrons *Lec.*
Actium augustum *Casey.*

Reichenbachia semirugosa *Brend.*
  rubicunda *Aubé.*
  inepta *Casey.*
  sodalis *Casey.*
Bythinus tychoides *Brend.*
  carinatus *Brend.*
Tychus minor *Lec.*
  verticalis *Casey.*
Pselaphus erichsoni *Lec.*
Actiastes foveicollis *Lec.*
Trimiomelba dubia *Lec.*
Melba thoracica *Brend.*
  sulcatula *Casey.*
Dalmosella tenuis *Casey.*
Trimioplectus obsoletus *Brend.*
Batrisus schaumii *Abé.*
  riparius *Say.*
  temporalis *Casey.*
  fossicauda *Casey.*
  frontalis *Lec.*
  harringtoni *Casey.*
  globosus *Lec.*
  clavicornis *Casey.*
  punctifrons *Casey.*
  furcatus *Brend.*
  denticollis *Casey.*
  striatus *Lec.*
  schmitti *Casey.*
Arianops amblyoponica *Brend.*
Decarthron abnorme *Lec.*
  longulum *Brend.*
Rybaxis conjuncta *Lec.*
Bryaxis arguta *Casey.*
Ctenistes piceus *Lec.*
  consobrinus *Lec.*
Geophyllus monilis *Lec.*
Tmesiphorus costalis *Lec.*
  carinatus *Say.*
Cedius ziegleri *Lec.*
  spinosus *Lec.*
Tyrus humeralis *Aubé.*
Cercocerus batrisoides *Lec.*
Adranes lecontei *Brend.*

STAPHYLINIDÆ.

Falagria venustula *Er.*
§ Tachyporus maculipennis *Lec.*
Mycetoporus consors *Lec.*
§ Homalium sp. nov.
§ Philonthus longicornis *Steph.*
§ Tachyntus schwarzi *Horn.*
* Trichopsenius depressus *Lec.*

SCAPHIDIIDÆ.

Scaphidium var. 4-pustulatum *Say.*

PHALACRIDÆ.

Olibrus vittatus *Lec.*
consimilis *Marsh.*
Phalacrus ovalis *Lec.*

COCCINELLIDÆ.

Hippodamia parenthesis *Say.*
Black var.
Harmonia picta *Rand.*
Exochomus contristatus *Muls.*
bipustulatus *Dej.*
Brachyacantha var. 10-pustulata *Melsh.* var. albifrons *Say.*
Scymnus puncticollis *Lec.*
punctatus *Melsh.*
intrusus *Horn.*
Pentilia misella *Lec.*

EROTYLIDÆ.

Languria angustata *Beauv.*
Megalodacne ulkei *Or.*
Myctotretus var. dimidiata *Lec.*
Tritoma macra *Lec.*

COLYDIIDÆ.

Aulonium species?
Erotylathris exaratus *Melsh.*

CUCUJIDÆ.

Silvanus bicornis *Er.*
Læmophlæus nitens *Lec.*

MYCETOPHAGIDÆ.

Mycetophagus bipustulatus *Melsh.*
pluriguttatus *Lec.*
pini *Ziegl.*

DERMESTIDÆ.

Trogoderma tarsale *Melsh.*
Cryptorhopalum balteatum *Lec.*
Anthrenus scrophulariæ *Linn.*
pimpinella *Fab.*

HISTERIDÆ.

Saprinus pennsylvanicus *Payk.*

NITIDULIDÆ.

Carpophilus pallipennis *Say.*
antiquus *Melsh.*
§ Epurea ovata *Horn.*
Soronia guttulata *Lec.*
Cryptarcha strigata *Fab.*

TROGOSITIDÆ.

Trogosita virescens *Fab.*
Tenebrioides var. limbalis *Melsh.*
rugosipennis *Horn.*
Calitys scabra *Thunb.*
Hesperobænus abbreviatus *Mots.*
Europs pallipennis *Lec.*

PARNIDÆ.

Elmis vittatus *Melsh.*

HETEROCERIDÆ.

Heterocerus limbatus *Kies.*
Heterocerus pallidus *Say.*

DASCYLLIDÆ.

Helodes apicalis *Lec.*
Eucinetus strigosus *Lec.*
Helodes maculicollis *Horn.*

RHIPICERIDÆ.

Sandalus niger *Knoch.*

ELATERIDÆ.

Melasis pectinicornis *Melsh.*
Phænocerus americanus *Horn.*
Microrrhagus humeralis *Say.*
Adelocera aurorata *Lec.*
§ Cryptohypnus perplexus *Horn.*
Elater nigricollis *Hbst.*
§ pedalis *Germ.*
§ Sericosomus honestus *Rand.*
Schizophilus subrufus *Rand.*
Agriotes stabilis *Lec.*
avulsus *Lec.*
Athous posticus *Melsh.*
Corymbites bivittatus *Melsh.*
medianus *Germ.*
Oxygonus obesus *Say.*
Melanactes puncticollis *Lec.*

BUPRESTIDÆ.

Anthaxia cyanella *Gory.*
Xenorhipis brendeli *Lec.*
Melanophila æneola *Melsh.*
Chrysobothris pusilla *Lap. & Gory.*
species?
Actenodes acornis *Say.*
§ Agrilus ruficollis *Fab.*
torquatus *Lec.*
§ pusillus *Say.*
§ anxius *Gory.*
§ blanchardi *Horn.*
Pachyscelus purpureus *Say*

LAMPYRIDÆ.

§ Eros humeralis *Fab.*
§ Plateros floralis *Melsh.*
Photinus marginellus *Lec.*
Telephorus flavipes *Lec.*
rotundicollis *Say.*

MALACHIDÆ.

§ Attalus morulus *Lec.*
circumscriptus *Say.*
§ 2 species?

CLERIDÆ.

Opilus domesticus *Kl.*
§ Trichodes nuttalli *Kirby.*
Clerus ichneumoneus *Fab.*
Hydnocera var. difficilis *Lec.*

PTINIDÆ.

Trichodesma species?
Trypopitys punctatus *Lec.*
Dinoderus porcatus *Lec.*
substriatus *Payk.*
brevis *Horn.*

CIOIDÆ.

Cis chevrolatii *Mellié.*
americanus *Mann.*

LUCANIDÆ.

Lucanus placidus *Say.*

SCARABÆIDÆ.

Onthophagus janus *Panz.*
* Pleurophorus ventralis *Horn.*
Euparia castanea *Serv.*
§ Aphodius rubeolus *Beauv.*
Odontæus filicornis *Say.*
Trox sordidus *Lec.*
Amphicoma vulpina *Hentz.*
Diplotaxis frontalis *Lec.*
Hoplia trifasciata var. tristis *Melsh.*
Dichelonycha testacea *Kirby.*
Species near canadensis *Horn.*
Lachnosterna congrua *Lec.*
hornii *Smith.*
knochii *Sch. & Gyll.*
ephelida *Say.*
2 species undetermined.
Cyclocephala immaculata *Oliv.*
Ligyrus gibbosus *De G.*
Aphonus castaneus *Melsh.*
Euphoria inda var. nigripennis *E. A. Klages.*

CERAMBYCIDÆ.

Tragosoma pilosicornis *Casey.*
§ Physocnemum violaceipenne *Ham.*
Elaphidion irroratum *Fab.*
unicolor *Rand.*
Heterachthes ebenus *Newm.*

Phyton pallidum *Say.*
Neoclytus devastator *Lap.*
§ Cyrtophorus gibbulus *Lec.*
Tillomorpha geminata *Hald.*
Bellamira scalaris *Say.* Black var.
Acmæops thoracica *Hald.*
Cacoplia pullata *Hald.*
Liopus cinereus *Lec.*
Lepturges var. pictus *Lec.*
§ Hyperplatys var. nigrellus *Hald.*
var. femoralis *Hald.*
Graphisurus pusillus *Kirby.*
Acanthocinus obsoletus *Oliv.*
nodosus *Fab.*
Hoplosia nubila *Lec.*
Pogonocherus mixtus *Hald.*
Eupogonius pubescens *Lec.*
Hippopsis lemniscata *Fab.*
Saperda obliqua *Say.*
Amphionycha flammata *Newm.*
Oberea var. myops *Hald.*
§ var. mandarina *Fab.*
var. affinis *Har.*

CHRYSOMELIDÆ.

Donacia harrisii *Lec.*
proxima *Kirby.*
Crioceris asparagi *Linn.*
Babia var. pulla *Lec.*
Saxinis apicalis *Lec.*
Bassareus detritus *Oliv.*
Cryptocephalus var. ornatus *Fab.*
var. cinctipennis *Rand.*
Cryptocephalus species?
Pachybrachys subfasciatus *Hald.*
Adoxus vitis *Linn.*
Hypolampsis pilosa *Illig.*
Haltica bimarginata *Say.*
carinata *Germ.*
Chætocnema denticulata *Ill.*
parcepunctata *Cr.*
Dibolia ærea var. ovata *Lec.*
Crepidodera scabricula *Cr.*

BRUCHIDÆ.

Spermophagus robiniæ *Sch.*
Bruchus species?

TENEBRIONIDÆ.

Xylopinus rufipes *Say.*
Adelina pallida *Say.*
Blapstinus interruptus *Say.*
Gnathocerus cornutus *Fab.*
Alphitobius var. piceus *Oliv.*
Platydema picilabrum *Melsh.*

CISTELIDÆ.

Chromatia New species?
Androchirus var. luteipes *Lec.*

MELANDRYIDÆ.

Orchesia gracilis *Melsh.*

MORDELLIDÆ.

Mordella borealis *Lec.*
Merdellistena bicinctella *Lec.*
limbalis *Melsh.*
biplagiata *Helm.*
Mordellistena bihamata *Melsh.*
angusta *Lec.*
3 species undetermined.

ANTHICIDÆ.

Anthicus scabriceps *Lec.*
Anthicus undetermined.

PYROCHROIDÆ.

§ **Ischalia costata** *Lec.*
§ **Schizotus cervicalis** *Newm.*

MELOIDÆ.

Zonitis bilineata *Say.*
Epicauta species.
* **Pomphopœa sayi** *Lec.*

RHIPIPHORIDÆ.

Rhipiphorus limbatus *Fab.*
Myodites luteipennis *Lec.*

STYLOPIDÆ.

Stylops childreni *Gray.*

OTIORHYNCHIDÆ.

Otiorhynchus monticola *Germ.*
Brachystylus acutus *Say.*

CURCULIONIDÆ.

Apion attenuatum *Smith.*
Lixus mucidus *Lec.*
  species undetermined.
Smicronyx griseus *Lec.*
Anthonomus rufipennis *Lec.*
  nigrinus *Boh.*
Elleschus bipunctatus *Linn.*
Læmosaccus plagiatus *Fab.* Var. all black.
Tyloderma variegatum *Horn.*
Cryptorhynchus obtentus *Hbst.*
  lapathi *Linn.*
  fuscatus *Lec.*
Cryptorhynchus 3 species?
Copturus operculatus *Say.*
§ **Cœliodes curtus** *Say.*
§ **Rhinoncus longulus** *Lec.*
Pseudobaris pusilla *Lec.*

CALANDRIDÆ.

§ **Sphenophorus ochreus** *Lec.*
  costipennis *Horn.*
  scoparius *Horn.*
  parvulus *Gyll.*
Cossonus crenatus *Horn.*

SCOLYTIDÆ.

Xyloterus scabricollis *Lec.*
Hylesinus imperialis *Lec.*
  aculeatus *Say.*
§ **Hylastes trifolii** *Mull.*
Dendroctonus rufipennis *Kirby.*

ANTHRIBIDÆ.

Tropideres bimaculatus *Oliv.*
§ **Alandrus bifasciatus** *Lec.*
Anthribulus rotundatus *Lec.*
Toxonotus fascicularis *Sch.*
Piezocorynus dispar *Gyll.*
  mixtus *Lec.*
Brachytarsus limbatus *Say.*
Cratoparis N. species?

NOTES.

CICINDELIDÆ.

Cincindela rufiventris is rare, occurring on sandy flats; **marginipennis** is a monticolous species, rarely found; **limbalis** is not rare on the hills about Jeannette and Wilmerding.

CARABIDÆ.

Cychrus stenostomus.—Found at Charleroi by Mr. G. A. Ehrmann.

Scarites substriatus.—Found on the shore of rivers; rare.

Aspidoglossa subangulata.—Found at light.

Pterostichus permundus.—Rare, in woods under stones.

Evarthrus americanus.—Rare, in ravines; **heros** and **furtivus** rare.

Dicælus carinatus.—One example taken near Indiana, Pa.

Platynus larvalis.—One example, collected by Mr. Ehrmann; **errans** and **rubripes** at light.

Galerita decipiens.—Three examples, under bark.

Lebia tricolor.—One example; **axillaris** and **collaris** by beating; rare.

Callida purpurea.—Rare; taken by beating.

Tachys ferrugineus.—Abundant in the nests of *Lasius aphidicola.*

Chlænius solitarius.—On river shore, under driftwood.

Anisodactylus verticalis.—At electric light.

DYTISCIDÆ.

Acilius mediatus.—Found at Wilmerding in small ponds; the other species at light. No special effort has been made to collect this family.

HYDROPHILIDÆ.

Cymbiodyta rotundata.—Rare here; the other species taken at electric light.

Sphæridium scarabæoides.—Taken here for the first time in 1900; occurring on manure in a pasture.

STAPHYLINIDÆ.

Falagria venustula.—Found on fungus in October; not common.

Trichopsenius depressus *Lec.*—One specimen was found in September, 1899, on the Chestnut Ridge, among Termes flavipes under a stone (Schmitt).

SCYDMÆNIDÆ.[1]

Euconnus clavipes *Say* and **bicolor** *Lec.*—No particular search has been made for these species, and hence only a few specimens of each have been taken, occurring under overturned tufts of grass. Dr. Hamilton has found these more frequently under stones. They are widely distributed species.

E. cavipennis *Cas.*—Occurs here in rotten wood, but is not common. It has been more abundantly found in the same material by Rev. Marcellus Rettger, in Carrolltown, Cambria County, situated in the Alleghany Mountains. The type, in Major Casey's collection, is the largest of the specimens I have seen.

E. accultus *Cas.*—Occurs in situations similar to those frequented by the last species, and not in greater abundance, unless one chances to find a colony. Even stray specimens are rarely taken. It is found on the Chestnut Ridge, and in its valleys; also in Cambria County (Rettger).

E. affinis *Cas.*—This is the **Scydmænus clavatus** *Lec.* of Dr. Hamilton's list. It is our most abundant *Euconnus*, occurring almost everywhere in western Pennsylvania, and at all seasons, in decaying wood, and other vegetable matter of all descriptions.

E. sp.?—A single specimen, running near **debilis** *Cas.*, was sifted from a heap of decaying weeds, June 6, 1896.

Pycnophus rasus *Lec.*—Widely distributed, but a rare capture to all collectors. Here a single specimen was obtained for me, in a chestnut stump, on the Chestnut Ridge, by Rev. Richard Kraus. It occurs in New Jersey, Iowa, Kansas and Canada.

Connophron oreophilum *Cas.*—Not abundant; all my specimens were obtained on the Chestnut Ridge, under decaying leaves and weeds.

C. fossiger *Lec.*—Has not occurred here yet, nor have I obtained it from Cambria County. But Dr. Hamilton has taken it not uncommonly under stones near Allegheny City, and his identification of the species is correct.

C. clavicorne *Cas.*—Widely distributed, and not rare in rotten wood, or under dead leaves.

C. luteipes *Cas.*—There are but a few specimens of this species in my collection, one of them a cotype of Mr. Casey's naming. It has occurred here.

[1] Notes by P. Jerome Schmitt.

C. comptum *Cas.*—Not very scarce. Has been found especially in leaves, heaped up against the base of large boulders on the Chestnut Ridge, and along the steep hillsides of the Loyalhanna Valley.

C. pallidum *Cas.*—Besides a cotype, there is but one other specimen from this neighborhood before me at present. Others will probably be found in my mounted, but unstudied material. It has occurred here under decomposing vegetation.

C. decorum *Cas.*—Not scarce in situations and localities similar to those in which *oreophilum* and *comptum* are found; the species usually occurring together, but not associated.

C. testaceipes *Cas.*—The cotype is the only specimen from this neighborhood now in my collection, and I have kept no record of its capture.

C. triviale *Cas.*—Sifted from layers of dead leaves, in woods, March 29, 1895.

C. castaneum *Cas.*—A single specimen, the cotype, collected at Carrolltown (Rettger).

C. parcum *Cas.*—The types are obtained here by sifting.

C. biceps *Cas.*—This tiny thing is the most remarkable of this great and complicated genus. My specimens have all been found here either singly, or in twos or threes at rare intervals, in rotten logs. Over a dozen have been obtained, the first on April 15, 1895.

C. caviceps *Cas.*—Another remarkable minute species, occupying a place apart from all others of the genus. I have but once taken a colony of small specimens, from the rotten stump of an oak. A large portion of the wood was riddled by the galleries of ants (*Lasius aphidicola*), which occurred numerously. A few other *Scydmænidæ*, and several species of *Pselaphidæ*, were also obtained by this sifting.

C. trinifer *Cas.*—This was formerly supposed to be but a variety of the next species; it is, however, easily distinguished from it by its obviously larger size and other characteristics.

C. fulvum *Lec.*—This and the preceding species are the two most abundant species of the genus *Connophron* in western Pennsylvania, and both are widely distributed over the Eastern and Middle States. Both frequent decaying logs of various kinds of wood, and with *C. affinis* can be found at all seasons.

C. bifidum *Cas.*—Besides a cotype, I have specimens taken from a rotten hickory log, and others taken October 5, 1899, from layers of dead leaves, all being found on the sloping hills along the banks of the Loyalhanna in the mountains.

C. mutilans *Cas.*—Several specimens were returned to me by Mr. Casey, after he had finished his very excellent and painstaking monograph of the family; they were sifted from piles of leaves and weeds on March 29, 1895. Not abundant.

C. capillosum *Lec.*—Has not as yet been taken here at St. Vincent's. A pair in my collection were received from Dr. Hamilton, and were taken by him with other specimens in Allegheny City.

C. longipilosum *Cas.*—A scarce species here and in Cambria County. Mr. H. Wenzel has taken it in New Jersey and I have also a pair from Covington, Kentucky, collected by Rev. P. Marcellus Rettger.

C. lacunosum *Cas.*—Rare; sifted from layers of dead leaves.

C. pallidipes *Cas.*—Of the pair in my collection, one specimen is from Cambria County (Rettger), the other was taken at St. Vincent's.

Scydmænus perforatus *Schaum.*—About half a dozen specimens were taken here by sifting rotten hickory logs.

S. badius *Cas.*—Occurs with the last species, and also in dead leaves and weeds piled up under bushes; not very rare.

S. turbatus *Cas.*—About a dozen specimens were taken from a linden stump, on June 27, 1896; the wood was soft and spongy through decay.

S. sp.? near **puncticeps** *Cas.*—The rather large punctures on the head are sparse and distinct. My single specimen was taken from the stump of a linden tree, February 17, 1897.

S. pubicollis *Cas.*—Seldom found; in decaying logs and stumps.

S. corpusculum *Cas.*—Not infrequently obtained, and always from layers of dead leaves, and only on the Chestnut Ridge and the Alleghany Mountains, Cambria County (Rettger).

S. caducus *Cas.*—Occurs with *corpusculum*, but is more abundant.

Opresus luteus *Cas.*—Abundant here and in the mountains, in decaying wood, throughout the spring, summer, and autumn seasons.

Opresus atomus *Cas.*—Not rare but less abundant than *luteus*. Has occurred only in the region of the Chestnut Ridge. These very minute insects are separable without the least difficulty by the marks mentioned in Mr. Casey's monograph; one of them may prove to be identical with **Scydmænus minimus** *Brendel.*

Delius robustulus *Cas.*—Another minute, and very interesting species, occurring sparingly in similar situations as *Opresus luteus* and *atomus*.

Neladius tenuis *Cas.*—A graceful insect, resembling a diminutive *Leptoscymnus*, and compared by me in the Hamilton list to **Scydmænus ovithorax** *Brendel.* It is rare, and found in the same locality and in similar material as *O. atomus.*

Cephennium corporosum *Lec.*—Have not yet found it here. Dr. Hamilton has taken it in spring, on several occasions, near Allegheny, in an orchard, under stones. The five specimens in my collection are from Covington, Kentucky (Rettger).

Ascydmus tener *Cas.*—Rare here, occurring in heaps of decomposing vegetation. A specimen sent to me for identification by Prof. Wickham, taken at Iowa City, cannot be separated from ours; and I suspect this species may prove to be synonymous with **Euthiodes lata** *Brendel.*

Eutheia americana *Cas.*—Found in sifted material from a decayed chestnut log on Chestnut Ridge, July 29, 1896, by Rev. R. Kraus. The type in Mr. Casey's collection is the only specimen known to me; I have failed thus far to duplicate it.

Veraphis capitata *Cas.*—Another rare species, obtained under dead leaves and weeds, only in the valley of the Loyalhanna.

V. cristata *Brend.*—The type in Brendel's collection, and now in the Horn collection at Philadelphia, was taken by Rev. M. Rettger at Carrolltown, Cambria County, and sent to me.

V. n. sp.—A single specimen was found on October 13, 1897, in the same location as *capitata;* it is certainly not the latter species, neither does it tally with the figure or description of *cristata.*

Leptoscymnus caseyi *Brend.*—Dr. Brendel's types came from Carrolltown, Cambria County (Rettger), but it, as well as the next species, occur here not infrequently in wood, and often in colonies.

L. cavifrons *Cas.*—Described by Dr. Brendel as the male of *Caseyi.* When the sexes are once known, it is easy to separate the two species. Not abundant.

Eumicrus motschulskii *Lec.* Single specimens, or pairs, are obtained now and then, but the insect cannot be said to be abundant.

Acholerops zimmermanni *Schaum.*—Not more common than the foregoing species.

A. retrusa *Cas.*—Referred to in the Hamilton List as *Eumicrus* n. spec. Since my first taking it, as there recorded, on December 26, 1894 (when it was thawed out of a lump of the material indicated), it has again been found in similar material, but not in the winter season.

PSELAPHIDÆ.[1]

Raphanus tolulæ *Lec.*—During the months of September, October, and November this species has been more frequently found than has been recorded in the Hamilton List. I have only taken it in this neighborhood in the valley of the Loyalhanna, in heaps composed of a mixture of pulverized and thoroughly decomposed wood, dead leaves and weeds, held together by numerous tough roots of rank vegetation growing thereon. I have also a few specimens taken at Covington, Ky., by Rev. M. Rettger.

Rexius insculptus *Lec.*—A widely distributed species, varying in size and in the shape of the head and thorax. Not rare.

R. schmitti *Brend.*—This is, almost beyond a doubt, a synonym of *insculptus.* The specimen described by Dr. Brendel is a male, and he himself in the course of time considered and ranked it as but a doubtful variety of *insculptus.* It is best suppressed.

Rexidius canaliculatus *Lec.*—Found everywhere in sifting all kinds of vegetable material.

R. trogasteroides *Brend.*—Very scarce under things in the valley of the Loyalhanna. It has not been found elsewhere as yet. It is hardly congeneric with *canaliculatus*, and it is a matter of surprise to me that it has thus far been allowed to remain in the genus in which it was originally placed by Dr. Brendel.

Ramecia crinita *Brend.*—Very scarce. Since the appearance of Dr. Hamilton's List I have taken only one specimen, on June 8, 1898. This was found under the bark of a fallen tree on the Chestnut Ridge, and walking about, accidentally, I presume, among a colony of ants (*Cremastogaster lineolata* Say).

R. dentiventris *Cas.*—Three specimens found on the Chestnut Ridge in moss under a stone.

R. arcuata *Lec.*—One male was taken in the valley of the Loyalhanna, and another in Carrolltown, Cambria County, by Rev. M. Rettger. The femora of the second pair of legs are very much swollen and arched.

Pycnoplectus tenellus *Cas.*—Not very scarce in various localities on the Chestnut Ridge and in Cambria County.

P. interruptus *Lec.*—Single individuals are occasionally found in woods in western Pennsylvania.

[1] By P. Jerome Schmitt, St. Vincent's Abbey, Pa.

P. sp.? **P.** sp.? **P.** sp.?—Three other species distinct from the foregoing, but near it, have occurred here in moderate numbers; I have not as yet been able with satisfaction to identify them with species hitherto described, and consider them new.

Euplectus longicollis *Cas.*—This name has been given me by Capt. Casey a few years ago for material sent to him for study. I have not, however, been able to recognize the species among my numerous captures of *Euplectus*, and record it on this list on the strength of the name which was returned to me.

E. confluens and **E. elongatus** are not scarce in western Pennsylvania.

E. new sp.?—A fine, hitherto undescribed species, very near *elongatus*, with which, diagnosed by the ventral marks of the males, it forms a distinct group in the genus. It is larger than any other *Euplectus* or *Pycnoplectus* known to me; two males and three females have been found by sifting in the Loyalhanna Valley.

E. iowaënsis *Cas.*—As frequently met as *confluens* and *elongatus*, and while distinguishable from them without great difficulty, I cannot separate it from a series of *iowaënsis* collected at Cedar Rapids, Iowa, and given to me by Dr. Brendel under the name of *E. confluens.*

E. pertenuis *Cas.*—A fine, small and abundant species, easily recognized in both sexes by the cephalic peculiarities; it frequents rotten wood.

Thesiastes fossulatus *Brend.*—A minute and very scarce insect in this locality, found in decaying leaves, October 25, 1897.

Bibloplectus rufipes *Lec.*—A still smaller species, which has been but rarely found in decaying oak logs.

B. leviceps *Cas.*—Besides the specimens from Cambria County recorded on the Hamilton List, a few have also been collected here; they are identical with a specimen in my collection, taken at Cedar Rapids, Iowa, by Dr. Brendel, and kindly given to me.

Entyphlus similis *Lec.*—Abundant, but only taken in the mountains, and not in the immediate neighborhood of St. Vincent's. Among a few hundred examples, only the males have been seen, these coming from Cambria County (Rettger), and considered by Raffray not to belong to the species *similis.*

Thesium cavifrons *Lec.*—Sometimes taken in small numbers under compost made up of weeds and grasses heaped up in corners of vegetable gardens. My specimens were so found on February 27, 1896; others have also occurred since then.

Actium angustum *Cas.*—Apparently a monticolous species occurring not commonly on the Chestnut Ridge, and more abundantly in Cambria County (Rettger).

Actiastes foveicollis *Lec.*—I have specimens from Cambria County, but as yet have taken none at St. Vincent's.

Trimiomelba dubia.—Four specimens have been taken at St. Vincent's by sifting; found in company with the next two species.

Melba thoracica *Brend.*—Found more frequently than formerly, but not as abundant as the following species.

M. sulcatula *Cas.*—This name is applied to *Trimium parvulum* of the former list. The shape of the middle tibiæ of the male will easily distinguish it from its near relatives. It has been found abundantly, especially in dead hickory wood, in an advanced stage of decay; I have also taken a few specimens with the sweeping net, in a dense grass plot, near sundown.

Dalmosella tenuis *Cas.*—Of this minute species, three or four specimens have been obtained in material similar to that which is frequented by *sulcatula*.

Trimioplectus obsoletus *Brend.*—Not rarely found, especially in very rotten portions of the trunks and larger limbs of trees.

Batrisus temporalis *Cas.*—This is the insect named *scabriceps* in the former list.

B. fossicauda *Cas.*—This is *bistriatus* of the former list.

B. harringtoni *Cas.*—Occasionally met with both here and in Cambria County in rotten logs and stumps.

B. globosus *Lec.*—Found in abundance almost everywhere in Pennsylvania.

B. cavicornis *Cas.*—This is *B. foveicornis* of the previous list; very rare.

B. striatus *Lec.*—Rare in our region; I have not taken another specimen since the former list appeared.

B. schmitti *Cas.*—This is *B. virginiæ* of Hamilton's List. Capt. Casey's type, a male in my collection, and one male which was lost, are the only specimens of this species which I have seen. These three were taken at different times, but in nearly the same situation, at a slight distance from the banks of the Loyalhanna River on the Chestnut Ridge.

B. schaumi, riparius, frontalis, globosus, punctifrons and **furcatus** have all been found repeatedly since the appearance of Dr. Hamilton's List.

B. fossicauda *Cas.*—Abundant in the nest of the ants mentioned in the first list; it feeds on the "springtails" that swarm in the ant-nests, and I have several times captured specimens in the nest, in the act of devouring their prey. Not a single specimen has been taken by me outside of the ant-nests, though I have seen specimens sitting at the entrance of the nests, or walking speedily from one entrance to another, or hurrying about on the earthwork as if ready to take wing. These observations were made about two hours before sunset. The ants seem to take no notice whatever of the beetles, nor do these concern themselves with the ants. I am of the opinion that the *Batrisi*, and the *Pselaphidæ* generally, may be expected to occur in greatest numbers in those situations in which the *Poduridæ* most abound.

B. denticollis *Cas.*—Seems to be restricted to a very limited number of localities.

Arianops amblyoponica *Brend.*—Long and patient search is required to collect a few specimens of this fine blind beetle, and my later observations confirm me in believing it to be myrmecophilous, for I have always found it near, or in the galleries of *Stigmatonuna* (*Amblyopone*) *pallipes* Hald. The type described by Dr. Brendel is a male, not a female, as erroneously stated in the first list.

Decarthron abnorme *Lec.*—Not rare under heaps of dead weeds, etc., along fences, and one of the few *Pselaphidæ* which I have taken on the wing an hour or so before sunset.

D. longulum *Brend.*—Referred to as a new species in Dr. Hamilton's list, and identified for me some years ago as *longulum* by Capt. Casey. No specimens have since been found.

Rubaxis conjuncta *Lec.*—Not abundant; the specimens taken here show no variation.

Bryaxis arguta *Cas.*—This is *B. perforata* of Dr. Hamilton's list. It has been taken here and on the Chestnut Ridge with the sweeping net toward evening. It is rare.

Reichenbachia semirugosa *Brend.*—Only the two type specimens are known to me to have been captured here.

R. rubicunda *Aubé.*—Not scarce in dead leaves and weeds piled up under bushes and about logs; it is less frequently found under stones in wooded land.

R. inepta *Cas.*—Two examples under stones in pasture on the slope of a hill.

R. sodalis *Cas.*—Less abundant than *rubicunda*, and in similar situations.

Bythinus tychoides *Brend.*—One example taken on the Chestnut Ridge.

B. carinatus *Brend.*—Abundant under leaves in the mountains at St. Vincent's and in Cambria County (Rettger).

Tychus minor *Lec.*—Rare and local.

T. verticalis *Cas.*—Rare and local. The male of this species has a T-shaped tubercle at the middle of the metasternum, which is lacking in *T. minor*.

Pselaphus erichsoni *Lec.*—The only western Pennsylvania specimen of this genus that I have seen is in the collection of H. G. Klages. It was taken at Jeannette by Mr. F. Knechtel.

Sognorus (Ctenistes) piceus *Lec.* and **S. consobrinus.**—In reference to these two species I have no remarks to add to those already made in the Hamilton List. My observations on the form of the palpi of *C. Zimmermanni* are positively correct.

Ceophyllus monilis *Lec.*—Not rare in the colonies of *Lasius aphidicola* and *L. claviger*. The ants seem to take no notice of the beetles.

Tmesiphorus costalis *Lec.*—Dr. Hamilton has recorded the capture of two specimens near Allegheny City; I have not seen these, or any others, from Pennsylvania. At Belmont, N. C., I have taken pairs of it in April, always under the bark of pine stumps.

T. carinatus *Say.*—A single specimen has occurred here under the bark of a dead hickory in spring.

Cedius ziegleri *Lec.*—Since Dr. Hamilton's record I have taken a pair in a nest of *Camponotus pennsylvanicus*, but have seen no others.

C. spinosus *Lec.*—A colony of thirty specimens was found in a linden log on February 17, 1897. It is generally scarce.

Tyrus humeralis *Aubé.*—Like *Cedius*, this is not often obtained. It is very probable that the specimens in my collection will prove to represent more than one species, when studied critically. I have it from St. Vincent's, and from Elk and Cambria Counties (Rettger).

Cercocerus batrisoides *Lec.*—About a dozen specimens have been taken in a decaying log near Carrolltown, Cambria County, by Rev. Mr. Rettger, during the autumn of 1896. Dr. Schaufuss has redescribed this genus under the name of *Upoluna*, his *U. crassicornis* coming from Upoluna, one of the Samoan Islands.

Adranes lecontei *Brend.*—Frequent and careful search has failed

to produce more specimens than are recorded on the first list under the name of *A. cæcus* in error.

TRICHOPTERYGIDÆ.

While I have listed no new species of this family there are thirty species found here, and separated by Rev. J. Schmitt, but as yet undetermined. These will form at least twenty-five additional species to our local list.

SCAPHIDIIDÆ.

Scaphidium var. **4-pustulatum** *Say.*—One specimen found under bark.

PHALACRIDÆ.

Olibrus vittatus *Lec.*—A few specimens collected at Crafton, Pa., by Mr. E. A. Klages.

O. consimilis *Marsh.*—Common here and in the Southern States.

COCCINELLIDÆ.

Hippodamia parenthesis var.—This singular variety is black with red markings, the colors being transposed from the usual form.

Harmonia picta *Rand.*—About twenty specimens taken near Jeannette in June.

Exochomus contristatus and **bipustulatus.**—Both rare at Jeannette on low bushes.

Brachyacantha var. **10-pustulata** and **albifrons** are both scarce at Jeannette.

Scymnus puncticollis and **punctatus** are rare at Jeannette. Of *S. intrusus* I found about fifty specimens under stones on December 21, 1896.

EROTYLIDÆ.

Languria angustata *Beauv.*—Three specimens found near Jeannette.

Megalodacne ulkei *Cr.*—This species is rare here in fungi on standing trees.

Myctotretus dimidiata *Lec.*—Rare at Jeannette on fungi.

COLYDIIDÆ.

Aulonium sp.?—Three specimens taken here, but as yet undetermined.

Erotylathris exaratus *Melsh.*—Found under the bark of fallen trees; rare.

MYCETOPHAGIDÆ.

Mycetophagus bipustulatus and **pluriguttatus** are rare here; found in fungus on standing trees; **pini** is found occasionally in the pine region.

DERMESTIDÆ.

Trogoderma tarsale *Melsh.*—Is rare here, two specimens are all I have found.

Cryptorhopalum balteatum *Lec.*—This species has recently made its appearance here for the first time in small numbers.

Anthrenus scrophulariæ *Linn.*—A few specimens were taken here by me.

A. pimpinella *Fab.*—While this species is not recorded to my knowledge elsewhere as found in the United States, I have taken it in Jeannette, and Mr. F. Knechtel has taken it at Indiana, Pa. I have also one specimen from Texas taken by Rev. G. Birkmann. This seems to indicate that this species has been introduced from Europe and perpetuated.

HISTERIDÆ.

Saprinus pennsylvanicus *Payk.*—While common in the Southern and Eastern States, this species seems to be rare here. I have only taken a few specimens.

NITIDULIDÆ.

Carpophilus pallipennis and **antiquus** have both been taken at Jeannette at electric light.

Soronia guttulata *Lec.*—Rare here under bark of fallen trees in the spring of the year.

Cryptarcha strigata *Fab.*—Not common here; found on decaying fruit.

PARNIDÆ.

Elmis vittatus *Melsh.*—Not rare here at electric light in July.

HETEROCERIDÆ.

Heterocerus limbatus and **pallidus** are rare here at electric light in July.

DASCYLLIDÆ.

Eucinetus strigosus *Lec.*—Four examples were found in a rotten log at Crafton, Pa., by E. A. Klages.

Helodes apicalis and **maculicollis** are not common here. Found at electric light, June and July.

RHIPICERIDÆ.

Sandalus niger *Knoch.* One example taken at Wilmerding by Mr. P. Forster.

TROGOSITIDÆ.

Trogosita virescens *Fab.*—Found from Vancouver Island to Florida; a few specimens found here.

Tenebrioides rugosipennis and **limbalis** are both rare here.

Calitys scabra *Thunb.*—A very rare insect here; more common on the Pacific coast.

Hesperobænus abbreviatus and **Europs pallipennis** are not scarce here in June.

ELATERIDÆ.

Melasis pectinicornis *Melsh.*—Only two examples of this curious beetle have been found at Jeannette, and a few at St. Vincent's (Schmitt).

Schizophilus subrufus *Rand.*—Two examples of this rare species were collected under bark at Crafton, Pa., by Mr. E. A. Klages.

Microrrhagus humeralis *Say.*—Is rare here, I have taken but two examples by beating.

Adelocera aurorata *Lec.*—A single specimen of this rare species occurred in Pittsburgh.

Elater pedalis *Germ.*—Found in Allegheny by Dr. Hamilton.

Elater nigricollis *Hbst.*—Common here. *E. militaris* has not been found here as yet; this species was wrongly determined in the last list.

Agriotes stabilis and **avulsus** are not rare in Westmoreland County and about Pittsburgh.

Athous posticus *Melsh.*—I have found only two specimens at Jeannette.

Corymbites bivittatus *Melsh.*—A few specimens of these have occurred at Jeannette.

Oxygonus obesus *Say.*—Rare about Jeannette, but rather common at Indiana, Pa.

Melanactes puncticollis *Lec.*—A rather scarce insect about Jeannette, found under bark, on the wing, and by beating.

BUPRESTIDÆ.

Xenorhipis brendeli *Lec.*—This remarkable and rare species was bred from wood at Crafton, Pa., by Mr. E. A. Klages; only a few specimens were obtained.

Melanophila æneola *Melsh.*—Bred from hickory wood in June.

Chrysobothris pusilla.—Only two specimens were obtained in Pittsburgh.

Agrilus ruficollis and **pusillus** are abundant here. *Torquatus* is not rare on hickory ; *anxius* and *blanchardi* are rare here in early June.

LAMPYRIDÆ.

Telephorus rotundicollis and **flavipes** are abundant in May and June.

Eros humeralis and **Plateros floralis** *Melsh*, are, like most of this group, rare about Jeannette.

Photinus marginellus *Lec.*—This species has probably been confused with *scintillans*, the female of which has short elytra, and seems to be a southern species ; the female of our local species has elytra as in the male, which would indicate the species *marginellus*, not *scintillans*.

CLERIDÆ.

Opilus domesticus *Kl.*—One specimen of this handsome insect occurred at Wilmerding.

Trichodes nuttalli *Kirby.*—I have seen specimens taken in western Pennsylvania, but never found one myself. No doubt it occurs here.

Clerus ichneumonius *Fab.*—Some years ago I took four examples of this fine species ; Mr. Ehrmann took quite a number of them at Charleroi, Washington County, Pa.

PTINIDÆ.

Trichodesma sp. ?—I find a species of this genus on hickory trees which is quite different from *gibbosa*, the elytra being deeply striate and punctate. It can be separated from *gibbosa* at a glance, and there seems to be no variation, the male and female having the same peculiarities.

Trypopitys punctatus *Lec.*—One specimen occurred at Jeannette.

Dinoderus porcatus and **substriatus** are found rarely in Westmoreland County. A few specimens of *brevis* were found under the bark of a dead tree which was standing.

Several species of this family are as yet undetermined.

CIOIDÆ.

Cis chevrolatii and **americanus** are occasionally found here in decayed fungi.

LUCANIDÆ.

Lucanus placidus *Say*.—This year for the first time I took quite a number of this species at electric light and also dug out some at the roots of a standing dead tree. The female seems to be very rare, as forty-nine out of fifty specimens were males.

SCARABÆIDÆ.

Onthophagus janus *Panz*.—This is the *O. striatulus* of Hamilton's List.

Pleurophorus ventralis *Horn*.—This rare insect was taken near St. Vincent's by P. Jerome Schmitt.

Euparia castanea *Serv*.—Two specimens taken at Jeannette.

Aphodius rubeolus *Beauv*.—Taken at electric light at Jeannette.

Odontæus filicornis *Say*.—A rare insect at Jeannette, I know of but few specimens having been taken.

Trox sordidus *Lec*.—I have some of these, and consider it not rare.

Amphicoma vulpina *Hentz*.—The only specimen I have seen from this region was taken at Greensburg, Pa., by Mr. Herbert H. Smith.

Hoplia var. **tristis** *Melsh*.—This variety I usually find on roses.

Dichelonycha testacea *Kirby*.—Rather common here in spring before the other commoner species appear.

Dichelonycha sp.?—An almost black species occurs here which Dr. Hamilton thought to be *canadensis;* I am not certain that the name is correct.

Lachnosterna congrua, hornii, knochii, ephelida, and two other species as yet undetermined occur here rather sparingly.

Cyclocephala immaculata and **Ligyrus gibbosus** have been found at Jeannette at electric light for the first time this summer (1900); a number of each were taken.

Aphonus castaneus *Melsh*.—Three specimens dug out from the roots of weeds.

Euphoria var. **nigripennis.**—This black form of *inda* is rare here; there are no intermediate forms, as in some of the southern species. Taken in September on the bark of willow trees near water.

CERAMBYCIDÆ.

Tragosoma pilosicornis *Cas*.—Two specimens were taken in Pittsburgh. It is erroneously quoted as *depsarium* on Dr. Hamilton's list. This species can easily be distinguished by Mr. Casey's description.

Physocnemum violaceipenne *Ham.*—Of this species I know but three specimens, all taken at Jeannette on oak.

Elaphidion irroratum *Fab.*—Rare near Pittsburgh; *unicolor* not rare on oak and hickory.

Heterachthes ebenus *Newm.*—A widely distributed species, but rare here.

Phyton pallidum *Say.*—Occasional specimens are found on young black-oak.

Neoclytus devastator *Lap.*—A simple example has occurred at Jeannette.

Cyrtophorus gibbulus *Lec.*—While classed as a synonym of *Macroclytus gazellula*, it was believed to be a distinct species by Dr. Hamilton.

Tillomorpha geminata *Hald.*—I have found about twenty specimens at Jeannette on hawthorn bushes.

Bellamira scalaris var.—Two specimens were taken at Wilmerding, Pa., which are entirely black. When compared with *scalaris* they are somewhat smaller in average size than the males, but I can find no other difference except in color. They are both males.

Acmæops thoracica *Hald.*—These can readily be separated from *bivittata* by the deeply concave, depressed thorax. They are very rare here.

Cacoplia pullata *Hald.*—This rare insect is seldom found here.

Liopus cinereus *Lec.*—While but a variety of *alpha*, the form should be listed; commonly found.

Lepturges var. **pictus** *Lec.*—Occasionally found on hickory.

Hyperplatys var. **nigrellus** and **femoralis.**—Bred from the limbs of chestnut trees.

Grapisurus pusillus *Kirby.*—Rare at Jeannette and in Pittsburg.

Acanthocinus obsoletus *Oliv.* and **nodosus** are both rare here.

Hoplosia nubila *Lec.*—A number of these were taken at Charleroi by Mr. G. Ehrmann.

Pogonocherus mixtus *Hald.* and **Eupogonius pubescens** *Lec.* are both rare here.

Hippopsis lemniscata *Fab.*—Two specimens taken at electric light. This species has a remarkable distribution. I have seen specimens from almost all the Middle and Southern States, as well as from the Atlantic States, and have specimens from Mexico, Costa Rica, and Chapada in southwestern Brazil.

Saperda obliqua *Say.*—This species has at last found its way hither; a few specimens were taken at several places in our region.

Oberea var. **myops**, var. **mandarina** and var. **affinis** are occasionally taken here.

Amphionycha flammata *Newm.*—Found on a dead linden-tree at Charleroi.

CHRYSOMELIDÆ.

Donacia Harrisii *Lec.* and **proxima** *Kirby* are occasionally found here in swampy places.

Crioceris asparagi *Linn.*—A few of the European asparagus-beetle have been taken here.

Babia var. **pulla** *Lec.*—Two examples from Jeannette.

Saxinis apicalis *Lec.*?—Several specimens of this genus have been taken here. I record it with some doubt as this species.

Bassareus detritus *Oliv.*—Rare about Jeannette on bushes near water.

Cryptocephalus var. **ornatus** and var. **cinctipennis.**—Not common at Jeannette; found with *C. venustus.*

Hypolampsis pilosa *Illig.*—One specimen collected at Jeannette.

Haltica bimarginata and **carinata** are both sparingly found at Jeannette.

Chætocnema denticulata and **parcepunctata** are not uncommonly taken with the sweeping net on low herbage.

Dibolia var. **ovata** *Lec.*—Found at Jeannette; rare.

Adoxus vitis *Sinn.*—I have only found this species in the valley of the Loyalhanna, May 30, 1898.

BRUCHIDÆ.

Spermophagus robiniæ *Sch.*—An occasional specimen of this is seen, as also a species of *Bruchus,* as yet undetermined, but new to our locality.

TENEBRIONIDÆ.

Xylopinus rufipes *Say.*—Several specimens of this southern species have occurred at Jeannette.

Adelina pallida *Say.*—Two specimens of this curious flat beetle were found under bark.

Blapstinus interruptus *Say.*—Found in Pittsburgh some years ago.

Gnathocerus cornutus *Fab.*—This cosmopolitan species has been found at Jeannette and in Pittsburgh.

Alphitobius piceus *Oliv.*—Not rare here in stables and rabbit pens.

Platydema picilabrum *Melsh.*—Common at Wilmerding and rare at Jeannette.

CISTELIDÆ.

Chromatia n. sp.?—While three varieties of *amœna* occur at Jeannette, the ventral segments of all these are red; in this species the ventral segments are black.

Androchirus var. **luteipes** *Lec.*—This form of *A. erythropus*, which has been confused with *A. fuscipes*, is seldom taken at Jeannette.

MELANDRYIDÆ.

Orchesia gracilis *Melsh.*—This species occurs at Jeannette under bark which is covered with fungi.

MORDELLIDÆ.

Mordella borealis *Lec.*—Has been taken here occasionally with the sweeping net.

Mordellistena.—The various species mentioned on this list are rare at Jeannette, and have been taken with the sweeping-net.

ANTHICIDÆ.

Anthicus scabriceps *Lec.*—Rare here. A species of *Anthicus* was taken in numbers, clinging to the under side of stones in midwinter. It is as yet undetermined.

PYROCHROIDÆ.

Ischalia costata *Lec.* and **Schizotus cervicalis** *Newm.* were taken by Mr. G. Ehrmann at Charleroi, Pa.

MELOIDÆ.

Zonitis bilineata *Say.*—Two specimens were taken at Jeannette.

Epicauta sp. ?—A number of specimens of a species new to our local fauna were taken, but are as yet undetermined; they resemble a small *cinerea* in appearance.

Pomphopœa sayi *Lec.*—This fine species has been taken near St. Vincent's by P. Jerome Schmitt.

RHIPIPHORIDÆ.

Rhipiphorus limbatus *Fab.*—Only once taken, and but few specimens.

Myodites luteipennis *Lec.*—One specimen taken on golden-rod.

STYLOPIDÆ.

Stylops childreni *Gray.*—While I have never seen a specimen of this curious insect, there is no longer any doubt that it occurs here,

and not rarely. The main difficulty is to collect them, as they are found in the bodies of living wasps of several species. Their presence in this locality is proved by finding on several occasions wasps from the bodies of which one to three specimens had already emerged, as also specimens containing larvæ.

OTIORHYNCHIDÆ.

Otiorhynchus monticola *Germ.*—A single specimen taken at Jeannette is identical with my specimens from Europe.

Brachystylus acutus *Say.*—Found in strawberries shipped from the south; perhaps it should not be listed.

CURCULIONIDÆ.

Apion attenuatum *Smith.*—Abundant at Jeannette on rag-weed.

Lixus mucidus *Lec.*—Two specimens were found at Jeannette; another species, new to our region, is as yet undetermined.

Anthonomus rufipennis *Lec.*—Rare here; *nigrinus* is rather common.

Elleschus bipunctatus *Linn.*—Not very rare at Crafton (E. A. Klages).

Læmosaccus plagiatus var.—This form has no red markings, being entirely black.

Tyloderma variegatum *Horn.*—Two examples occurred at Jeannette.

Cryptorhynchus obtentus *Hbst.* and **lapathi** *Linn.* are rarely found in our locality.

Copturus operculatus *Say.*—An occasional specimen of this is found.

Cœliodes curtus and **Rhinoncus longulus** are found near Allegheny and at Crafton.

Pseudobaris pusilla *Lec.*—This species, so determined by Dr. Hamilton, is not rare here.

Cryptorhynchus fuscatus *Lec.* and three species, as yet undetermined, were found at Crafton by E. A. Klages.

CALANDRIDÆ.

Sphenophorus ochreus, costipennis, scoparius and **parvulus** are occasionally collected at Jeannette.

Cossonus crenatus *Horn.*—A few specimens of these have occurred at Jeannette and at Pittsburgh.

SCOLYTIDÆ.

The various species of this family, which have been listed, occur here, but as yet not many specimens of these species have been obtained.

ANTHRIBIDÆ.

Tropideres bimaculatus *Oliv.*—One example taken at Jeannette.

Alandrus bifasciatus *Lec.*—This is the "*A. new species*" of Hamilton's List.

Toxonotus fascicularus *Sch.*—Only one example of this species has been found by me.

Piezocorynus dispar and **mixtus** are rare at Jeannette on dead trees.

Anthribulus rotundatus *Lec.*—Not rare at Jeannette; often collected with the sweeping-net.

Brachytarsus limbatus *Say.*—Found at Crafton by E. A. Klages, who also collected an undescribed species of *Cratoparis*.

IX. OSTEOLOGY OF THE FLAMINGOES.

(ODONTOGLOSSÆ.)

FAMILY: PHŒNICOPTERIDÆ, Sp. *P. ruber*.

BY DR. R. W. SHUFELDT, C.M.Z.S.

What I have to say here upon the osteology of this small but very interesting group of birds is based upon a complete disarticulated skeleton of *Phœnicopterus ruber* (No. 18494) belonging to the U. S. National Museum, and also a fine mounted skeleton of a Flamingo in the collections of the same institution of which I present a plate. *P. ruber* has been known to occur at rare intervals in Florida, and from the Florida Keys it ranges southward to an undetermined latitude. Other species occur in various parts of the world, and the distinguished French savants Professors Gervais and A. Milne Edwards have described a number of fossil Flamingoes. *P. copei* has also been described by the present writer, it having been discovered in the Equus Beds of Oregon (Tertiary U. S.).

The great weight of opinion among the best avian taxonomers is in favor of creating a distinct group to contain these birds, and that its place in the system is to be found between the true *Anseres* on the one hand, and *Herodiones* on the other. This was even the opinion of Linnæus who claimed they stood "medium inter *Anseres* et *Grallas*, si quis ad præcedentem ordinem referat, forte non errat" (*Syst. Nat.*, ed. 12, I, p. 230), though he retained the Flamingo known to him (*P. antiquorum*) in the latter assemblage. A century later Huxley arrived at practically the same opinion, and in the Proceedings of the Zoölogical Society of London, for 1867, made a group, the *Amphimorphæ*, to contain these birds alone, placing it immediately between the *Anatidæ* (Chenomorphæ, with *Palamedea*) and the herons, storks and *Tantalidæ* (Pelargomorphæ). Professor W. K. Parker, however, has dissented from this view, saying "Professor Huxley has overstated the Anserine characters of this bird [Phœnicopterus]; its 'basipterygoids' are aborted, as in the Ibises."[1]

[1] On the "Manus" of Phœnicopterus, see The Ibis for April, 1889, p. 185.

Garrod's view of the position of the Flamingoes seems to me to be one of the most unnatural that has been published up to the present time. They are placed in his "Cohort B" of his Order GALLIFORMES of his Subclass HOMALOGONATÆ, thus:

Cohort (B) GALLINACEÆ.
  Family 1. Palamedeidæ.
    2. Gallinæ.
    3. Rallidæ.
    4. Otididæ.
   Subfamily 1. *Otidinæ.*
     2. *Phœnicopterinæ.*
  Family 5. Musophagidæ.
    6. Cuculidæ.
   Subfamily 1. *Centropodinæ.*
     2. *Cuculinæ.*

Dr. Sclater arrayed them as an Order (VIII) Odontoglossæ, standing between the Herodiones and Palamedeæ; the latter being followed by the Anseres (Order X).

Professor Alfred Newton believed that "the *Phœnicopteri* so much resemble the *Anseres* in certain points that they should form a Suborder of that group, equal in value to the true *Anseres* and the *Palamedeæ.*

Reichenow places them in his Order (VII) GRESSORES as a family (28) between the *Ciconiidæ* (27) and the *Scopidæ* (29), while Stejneger creates a superfamily for them, the *Phœnicopteroideæ*, of his Order (VIII) Chenomorphæ, which last is followed by the Order (IX) Herodii.

Dr. Fürbringer places the two families *Palæolodidæ* and *Phœnicopteridæ*, as one of the "Gens" (Phœnicopteri) of his Suborder Ciconiiformes of the Order PELARGORNITHES; and Mr. Seebohm gives us the following, extracted from his classification:

SUBCLASS.	ORDER.	SUBORDER.
4. Galliformes.	Lamellirostres.	23. Palamedæ.
		24. Anseres.
		25. Phœnicopteri.
	Gallo-Grallæ.	26–32.

Doctor Bowdler Sharpe places them as an Order PHŒNICOPTERIFORMES (XXI) between the Orders PELARGIFORMES (XX) and ANSERIFORMES (XXII), which is quite in keeping with the prevalent opinion of the present time. On the other hand Gadow places the

Flamingoes among his *Ardeiformes* as a family, and far removed from the *Anseres*,[1] which latter are found in his *Anseriformes*, and these are separated from the *Ardeiformes* by the *Falconiformes*.

Many other authorities could be cited here, but from what has been given it is clear that a great variance of opinion still obtains among us as to the position in the system the Flamingoes really occupy.

It is my intention here to compare the skeleton of *Phœnicopterus ruber*, bone for bone, and character for character with the corresponding ones as they occur in the skeletons of all our N. American Mergansers, Ducks, Geese and Swans on the one hand, and the Ibises, Herons, Storks and their immediate allies on the other. Not that I hope that such a comparison will settle the matter for good and all, as to the affinities of the Flamingoes, because the only true way to arrive at such a desirable end as that, is to compare and intercompare the characters presented in the *entire* structure of all these groups. It will show, however, what the skeleton has to say on the subject, and so far as it goes, the results arrived at will be set forth in the present memoir.

COMPARATIVE OSTEOLOGY OF PHŒNICOPTERUS RUBER.

Of the Skull.—Omitting the consideration of the lower jaw or mandible, for the present, as well as the ossifications of the organs of special sense, and directing our attention to the remaining part of the skull, the remarkable form of the upper jaw of the Flamingo first commands the attention. This has a length more than twice that of the cranium proper, while in the matter of its special shape it stands quite unique among birds. Its distal moiety is bent downwards upon the proximal half at an angle of rather more than a right angle. This gives to its mid-longitudinal line upon its under side a sudden curve at the point of flexure, while the corresponding line upon the upper side is more abrupt and angulated. Upon both sides, as well as at the apex of this mandible the free edges are very sharp and are directed directly outwards. The anterior or downward-bent portion of this osseous superior mandible is very much compressed and flattened in the antero-posterior direction; its extreme point being slightly bent backwards. On the upper surface it exhibits a central leaf-like area, lanceolate in outline, that has upon either side, near the lateral boundary a single row of very pronounced foramina. The remaining sur-

[1] P. Z. S., 1892, p. 229.

face between this leaf-like area and the free-edge of the beak upon this aspect is ornamented with a series of shallow pitlets, placed close together upon either side, which have at their mesial terminations subconcealed foramina leading into the interior of the bone. Passing to what may be called the horizontal portion of this upper mandible, we find that its average width is somewhat less than the part we have just been considering; its narrowest portion being anterior to the narial apertures. The culmen is flattened and very slightly rounded from side to side, the nasal bones being large, broad and smooth. All the sutures between these, the frontals, and the premaxillary are quite obliterated in the skull of the adult, and the bill shows a tendency to a slight rounded elevation, in front of the transverse, fairly-well marked cranio-facial line. Either narial aperture is very large, subelliptical in outline, and in no way separated from the opening of the opposite side by an osseous nasal septum. In front of these apertures, the sides of the superior mandible are lacking in a covering of compact bony tissue, and as a consequence the cancellous nature of the interior is considerably exposed at these places. This state is continued backwards along the otherwise solid supero-median floor of the nose, to a point where the large maxillo-palatines meet each other across the middle line. The under surface of the upper beak is upon the whole smooth, while its central longitudinal portion is raised above the rest of the surface as a rounded crest or elevation. This is best marked anteriorly, as it bifurcates and becomes flatter as we pass to the rear posterior to the flexure, where it usually shows in the median line a few foraminal elongated vacuities. These lead into the cancellous interior of the bone.

Regarding the superior aspect of the cranium proper we have to notice that the frontal region is depressed, and triangular in outline; the base of this triangle being formed by the cranio-facial line, and its apex by the approximation of the supra-orbital glandular depressions. These last are very large and well marked in the Flamingo, and closely approach each other in the median line. The trans-orbital interval is narrow, and the supero-orbital peripheries are subcultrate, or moderately rounded off. We are permitted to see also upon this view of the cranium, the extensive suture, upon either side, formed by the articulation of the lacrymal with the corresponding fronto-nasal border. More posteriorly, the parietal region is rounded and smooth, and is entirely lacking in anything like a median furrow extending

between the frontal region and the supra-occipital prominence, as in many of the Ibises and *Anseres*. At the back of the cranium, the elevation to which reference has just been made, is a very conspicuous feature, and upon either side of it is a large subelliptical foramen, the pair being similar to those vacuities which we find located in this place in such an Ibis as *Plegadis*; in many typical Ducks, as *Aythya vallisneria*; but which are small in certain Geese, as *Bernicla canadensis*; and may be entirely absent in Swans, as they are in *Olor buccinator*. *Phœnicopterus* has a large *foramen magnum*, the plane of which faces almost directly backwards, and but slightly downwards; its major axis is in the vertical line. The occipital condyle is comparatively small, and exhibits no supero-median notch as in the *Anseres* (as a rule), and in the Ibis *Plegadis*, where it is at least evident. No sharp osseous ridge defines the occipital area at the back of the skull in our Flamingo, as it does in almost all Ducks, Geese, and Swans. Such a ridge is also wanting in many Ibises, still the *general facies* of the hinder view of the skull of the Flamingo is more, considerably more, like that of *Bernicla* than it is like that of *Plegadis*. A good deal of this is due to the fact that the temporal fossæ of the Flamingo are small and entirely lateral, thus agreeing in this particular with the Goose and not with the Ibis, where they are elongated and produced backwards to the supra-occipital prominence.

Turning next to the lateral view of the skull, we are at first struck with the great size of the *lacrymal bone*. This never co-ossifies with the frontal and nasal at any time in the life of a Flamingo, as it does in all true adult anserine birds, and in many Ibises. It is in form broad, being somewhat transversely compressed; with a sharp ragged anterior border, and a thickened posterior one. On its outer aspect, at the junction of its upper and middle thirds, it is marked by a distinct horizontal groove, while below this, the descending body of the bone is composed of a narrow, vertical, thickened posterior part, with smooth external surface, and a thin anterior part, which latter is abundantly riddled with numerous minute perforating foramina. Both upper and lower borders are roundly convex, the superior one being the more extensive, and articulating for its entire length with a concave facet offered to it by the united frontal and nasal bones. The lacrymal does not come in contact with the zygomatic arch below, nor does it meet any of the other elements of the skull not mentioned. Indeed, these great lacrymals in a Flamingo are quite independent,

and hang down as very conspicuous features of the lateral aspect of the skull. In most particulars they are like the lacrymals as found among many Geese and Swans, and entirely different from those bones in such an Ibis as *Plegadis*, or its near allies. In all true *Anseres*, however, the lacrymals always anchylose with the cranium in front of the orbit.

Either *zygoma* in *Phœnicopterus* is a straight, stout bar of bone, that is more or less transversely compressed. At its proximal end it develops the usual little inturned process for articulation with the quadrate, while along its shaft all traces of the sutures indicating the original bones that enter into its composition are absent in the adult. Beyond the lacrymal it gradually becomes very much broader, and twists upon itself so that the anterior part of the *maxillary* portion lies quite in the horizontal plane. This extremity, fusing completely with the surrounding bones, passes in *between* the maxillo-palatine and the palatine, being *above* the latter. In the Swans, Geese and Ducks the zygoma is much slenderer; shows very little enlargement and no twisting anteriorly, and in them passes in between the pre-maxillary and palatine, being *below* the latter. This is a radical as well as a very interesting difference.

In *Plegadis* the maxillary end of the zygoma lies *above* the anterior end of the palatine of the same side. A large vacuity exists in the interorbital septum of the Flamingo, and in either orbit another extensive foraminal opening occurs above this in the anterior wall at the brain-case. Both in Ibises and anserine birds the interorbital septum is more or less entire, though the foraminal openings into the cephalic-casket may be of the same size, especially in the former group. In *Plegadis* the *pars plana* meets the lacrymal of the same side, but in neither the Flamingoes nor in the true anseres do these ethmoidal wings of the mesethmoid develop in bone.

In *Phœnicopterus ruber* both the post-frontal and the squamosal processes are very much aborted, and the temporal valley between, though deep, is of limited extent. These processes are likewise singularly small in *Plegadis*. A very different state of affairs exists in the *Anseres* in this particular. In them the squamosal process may be quite absent or, if present, so small as not to attract attention. On the other hand, these birds usually possess a post-frontal process of uncommon length. Its tendency is to extend forward and meet the backward extending lacrymal bone. This is actually accomplished in the duck known as

Dendrocygna autumnalis, the ends of the two bones completely fusing and thus forming an orbital osseous ring co-equal with anything we find of the kind among the Parrots.

Flamingoes have the osseous ear-cavity very much exposed, for after the quadrate is removed there is hardly any bony protection, and it is only at the back that a solid wing of good proportions semi-surrounds it in that quarter. Both the Ibises and the Anseres are better off in this particular; especially the first-named group. Without entering upon details, I may say that upon the whole the characters of the osseous ear-cavity and its most immediate surroundings in our Flamingo agree better with those same parts as we find them in *Bernicla* than they do with those in such an Ibis as *Plegadis*. Turning next to the base of the cranium, we find the triangular area formed by the *basitemporal* to be comparatively limited in extent. Its mid-anterior apex is thin and scale-like, and the Eustachian passages are for the most part open canals. This is what occurs in *Plegadis*, whereas in the anserine types these tubes are not thus exposed, while the median point in front where they in common open is, in these birds, large and conspicuous. The *basisphenoidal rostrum* is slender in the Flamingo, and more or less flat upon its under side. In front it terminates abruptly at the antero-inferior angle of the mesethmoid. The paroccipital processes are but moderately developed, and the pteryapophysial ones are not found. These latter are notoriously large among the *Anseres*, as may be appreciated by referring to my work upon the osteology of that group (in MSS.).

It is an interesting fact to note that upon the left side in the skull of the Flamingo at my hand, at the site where the pteryapophysial facet would be found in a Goose, for example, we observe a minute "prickle" of bone protruding, that would lead one to suspect the presence of these processes in birds allied to our subject, even did we not know of its relations to the Anseres. This sometimes happens in other groups, and may be the case within the group. Ibises are entirely wanting in pteryapophysial processes. In the Flamingo, a *pterygoid* is a short bone, being very markedly compressed in the vertical direction, while its anterior end is considerably dilated. I am not sure that these bones are in contact anteriorly (where articulated *in situ*); as is so distinctly the case in *Plegadis*. Otherwise the pterygoid of the Flamingo more or less resembles that bone as it occurs in the skull of the Ibis just mentioned, and very different from the pterygoid as it exists in any of the *Anseres*.

As compared with the other elements of the skull, *Phœnicopterus* has a big *quadrate*. Its orbital process is broad, thin and quadrilateral in outline, with the internal free extremity abruptly pointed ; its mastoidal portion is compressed in the oblique antero-posterior direction, and distinctly exhibits the double head for articulation with the skull. At its mandibular base the arrangement of the facets, as well as their forms, differ very materially from what we find in either the anserine birds or among any of the ordinary Ibises, though they agree better with the latter than they do with the former. This is somewhat remarkable from the fact that the orbital process of the quadrate in our Flamingo is more like that part of the bone as seen among Swans, Geese, and Ducks than in such an Ibis as *Plegadis.* Both the quadrates and the pterygoids of *Ajaja* (*Platalea*) are manifestly different in their important characters when compared with those bones in either the *Anseres* or the Ibises, or even the Flamingo. For their posterior moieties, in the middle line, the *palatines* are pressed together with the greatest intimacy, and we find here, coössified with them, the vomer which will be described further along. Viewing these bones from beneath we observe that the meeting between them is for the entire length of the "ascending process" of each, to include posteriorly the pterygoidal processes. Their "bodies" are flat, lie in the horizontal plane, are each rather broader in front than behind, and are likewise nearly parallel to each other. A very considerable median interval, or open space, separates the body of one palatine bone from that of the other, while anteriorly they pass beneath the maxillaries to become completely fused with the premaxillaries and maxillo-palatines. The "postero-external angle" of either palatine is rounded off, and both the internal and external laminæ are but feebly developed.

This by no means applies to the ascending process upon the superior aspect of the bone, for this is a most elegant scroll-like affair, that springs from almost the entire outer margin of the supero-external border of the body of the bone, to sweep upwards and inwards, to meet and fuse with the postero-superior edge of the vomer. The anterior border of this ascending process of either palatine, is seen to be a deep, loop-like curve, with its concavity directed to the rear. The inner line of the curve is continuous with the superior border of the vomer, while the outer sweep of the curve passes across the body of the palatine to finally become continuous with the mesial edge of the same.

As I have said, the *vomer* is fused with the palatines, and it is nowhere closely in contact with any of the other bones of the skull. Its free anterior end is pointed, and its inferior margin extremely sharp. Indeed, this thin plate of bone is greatly compressed in the lateral direction, while its body shows a large elliptical vacuity in it, just beneath the mesethmoid. This last-named element of the skull is much thickened superiorly where it is greatly spread out beneath the frontal bones with which it is indistinguishably coössified in the adult. Its supero-anterior edge is transverse, being devoid of any projection, and is found almost exactly beneath the line of the very firm and almost immovable cranio-facial hinge.

A *maxillo-palatine* is a large, somewhat concavo-convex bone, that exhibits an open spongy structure upon its external and convex surface, but a smooth compact one upon its concave mesial aspect. Externally, it fuses with the nasal, maxillary, premaxillary, and the extreme anterior end of the palatine, while internally it most completely coalesces across the middle line with the fellow of the opposite side. The maxillo-palatines of a Flamingo are decidedly anserine in character and do not reach back posteriorly to come in contact with the entire anterior margin of the ascending process of the palatine, of either side as they do in *Plegadis* but never do in such a goose as *Bernicla*, for example.

The *mandible* of *Phœnicopterus* is a truly elegant structure in bone, and it further possesses a form that is quite unique among birds. Its anterior half is bent downwards at an angle that coincides with the decurvature of the upper jaw, but instead of this part being flat and thin as in the case of the latter, it is vertically very deep at the point of flexure, though it tapers off gradually towards the apex, and posteriorly towards the rami. This part is moreover profoundly scooped out internally where the surface is smooth and composed of a very thin layer of compact tissue. From the rami to the apex, the two superior borders of this dentary part of the mandible are very considerably rolled inwards towards the median plane. These inturned edges, however, again gradually die out as we proceed towards the anterior tip of the bill, or upon the ramus upon either side. In a similar manner too, the general concavity of this dentary portion of the beak dies out gradually as we near the anterior apical extremity. Of course this is not the case posteriorly where considerable depth is maintained throughout. All over the enlarged dentary portion the

external surface shows its cancellous structure, and it is only meagrely covered in certain places by irregular areas of very thin compact osseous tissue. These are generally off-shoots from the external surface of the rami. The superior surfaces of the inturned borders of the dentary portion do not show this cancellous structure, but are smooth and unmarked, with their inner free edges rather sharp. Viewed upon its inferior aspect, the hinder boundary of this part of the mandible is seen to be concave, with the convexity directed forwards and it is marked by a deep, median, quadrilateral notch. Beyond this notch the bone is profoundly and broadly furrowed mesially, for the distance of about three centimeters. A median crest of bone divides this furrow into two equal longitudinal halves. The excavation dies out within about two centimeters of the surface, marked distinctly by a dozen or more peculiar striæ that converge towards the tip of the bill, but fail quite to reach it. Either ramus of this mandible is smooth, and for the most part shows no cancellous structure. Its upper and lower borders are rounded off, especially the superior one. Anteriorly, just before passing into the dentary portion, described above, it is somewhat swelled from side to side. On the mesial aspect of the ramus, between this locality and the articular cup, there is found an elongated elliptical concavity, showing some cancellous structure in its anterior portion. The outer surface of either ramus is very smooth and the ramal vacuity is *completely* obliterated. On this surface, below the coronoid process, a small subcircular foramen is constantly found. From the fairly-well marked coronoid process to the mandibular articulation, the superior ramal border drops abruptly. The "articular cups" present nothing very peculiar; they have the usual inturned hooked mesial processes, with the pneumatic foramen on the upper side, near the apex. The articular concavities and convexities are conformed to meet the opposing articular surfaces offered on the part of the mandibular articulatory process of the quadrate.

The apophysis at the angle of the jaw is conspicuously developed, and uniformly recurved upwards and backwards. Its lower and hinder margin is dull, and directly continuous with the inferior margin or border of the ramus. The anterior margin is jagged and sharp, while the apex is rather squarely rounded off. As in the anserine fowl, these angular apophysial projections are lamelliform in character, being thin and greatly compressed in the transverse direction.

In my specimen of *Phœnicopterus ruber* the *sclerotal plates* of either

eyeball have been lost, so I am at present unable to record anything about them. This also applies to the intrinsic bonelets of the middle ear, and still more unfortunately to the ossifications of the hyoidean apparatus.

For the most part, the skull of the Flamingo, including the mandible, is highly pneumatic; even more so than it is in many geese, as for example, in *Bernicla*. From quadrates to apices, the osseous mandibles of *Phœnicopterus* are more or less closely in contact when thus articulated *in situ;* this is especially the case for the anterior moieties of the dentary portion, and as it is known, these are the parts of the beak, principally used by the bird in the seizure of its food, taking it in a manner as it does, different from that of any other member of the class *Aves*—for with neck bent down, and head completely upside down—the flat anterior surface of the superior mandible is brought opposite to the bottom of the water where the individual may be feeding, while the mandible or lower jaw is *above*, occupying the position of the *upper jaw* in representatives of other groups while thus occupied.

In its external narial apertures; in the possession of supraorbital glandular depressions; to a small degree in its lacrymal bones; in the posterior aspect of its skull (generally); in its quadrates; in the possession of large recurved processes at the mandibular angles—the skull of the Flamingo is more or less anserine in character. But on the other hand, in its pterygoids; in some respects in its palatines; to some degree in its vomer; and in some other minor points, the skull of this bird is more or less ibidine in character. Finally, the skull of *Phœnicopterus* has a number of characters strictly peculiar to itself—but these have already been sufficiently dwelt upon above. I have also carefully compared the skull of *Phœnicopterus* with the skulls of an *Ardea;* with *Tantalus;* a stork; and with *Ajaja*, but in this part of its skeleton, I am convinced that it comes nearer the typical Ibises than it does any of these other groups or genera. To be sure it has a character here and there in its skull that more or less closely resembles a corresponding one, say in the skull of the heron, or another in a stork, but to me the ibis-characters seem to predominate.

On the Remainder of the Axial Skeleton.—There are 43 vertebræ and a pygostyle in the vertebral chain of the trunk skeleton of *Phœnicopterus ruber*. Of these, the first 18, counting from the atlas backwards,

are free ; while in the dorsal region the 19th, 20th, 21st and 22d are solidly fused together so as to form a single bone. The 23d vertebra is again free, after which the succeeding 14 are coössified together to form the pelvic sacrum. Finally we find 6 free caudals in the skeleton of the tail, plus a terminal *pygostyle*, which last is comparatively very small for the size of the bird, being somewhat elongated, pointed and shaped like a blunt lance-head. It is a process projecting forwards from its antero-inferior angle.

The *atlas* has the usual ornithic-type form, with its cup for the occipital condyle profoundly and roundly notched above, while its inferior spine is conspicuous, rather elongated, and is extended directly backwards. Passing this vertebra, the first thing that commands our attention in the cervical system of bones is their unusual slenderness, and their progressive elongation from the axis vertebra to include the 12th of the chain—the 9th to the 12th inclusive having almost exactly the same length, or about 5.3 cm. After the 12th they gradually shorten and widen again, until they come to assume the form of vertebra seen in the dorsal region. Through these elongated vertebræ the neural canal is also small, and even does not exhibit much increase of calibre where the neural cord gives off the brachial plexus. With the exception of the caudal vertebræ the entire chain of bones seems to be more or less pneumatic, the atlas, perhaps, being the least so of all, and the consolidated piece of the back the most so.

The *axis vertebra* has a long, low, thickened neural spine with broadly rounded superior edge ; its hæmal spine is likewise reduced to an elongated low crest with its inferior border somewhat sharpened. The odontoid process is prominent, pointed and somewhat tipped up in the direction of the neural canal. A long, extremely low, sharp and thin neural crest, longitudinally disposed, is also found upon the third vertebra, and upon all its successors to include the twelfth. It suddenly shortens up and becomes slightly more manifest in the 13th—distinctly so in the 14th and 15th—while in the 16th it is the most conspicuous feature of the bone, short, lofty and markedly bifurcated behind. This is pretty much the case, too, in the 17th and 18th segments, while in the coössified dorsal piece the neural crest is for the most part low and inclined to be spreading, especially anteriorly. In the free 23d it is much shortened, high, and considerably thickened. On the extreme forepart of the third vertebra there is a short median hæmal spine, that in the case of the 4th vertebra becomes distinctly bifid,

forming the parapophysial canal for the carotid arteries. This canal remains open throughout the series, where it is always seen to be short and situated at the extreme anterior part of the centrum beneath. It is well marked in the last five or six vertebræ of the neck, and even appears to be present on the 19th vertebra, or the first one of the solid dorsal bone. Its place is taken by a single, forward-directed spine on the 20th, and after that every trace of it disappears. The lateral vertebral canals are also at the extreme anterior part of the several cervical vertebræ that possess them, and they, too, are very short, being found first in the third cervical, and continue to be present to embrace the seventeenth. After that free pleurapophyses are in order. These vertebral canals are of very small calibre in the leading cervicals, but gradually become larger, until they are of some size in the 16th, 17th and 18th vertebræ. The parapophysial spines form a very remarkable feature, they being of very considerable length, and of absolutely hair-like dimensions. In the 15th vertebra the pair suddenly shortens up, to become quite unnoticeable, and in the 16th vertebra they are supplanted, upon either side, by a low inconspicuous tubercle. The 15th vertebra is also peculiar in possessing interzygapophysial bars, which are so often present in the third cervical of other birds, but which in the present bird are almost aborted in that segment of the spine.

The zygapophysial processes are very short and thick in the first six cervicals, leaving, when the vertebræ are articulated, no lozenge-shaped interspace upon vertical view between the bones, but in the seventh vertebra the posterior pair begin to elongate, and this is continuous to include the 14th, whereupon they again shorten and thicken throughout the lower part of the neck and the back. When the vertebræ are normally articulated in the cervical region, the spine there forms a long sigmoid curve down to the dorsum. As a rule the articular facet on the anterior part of the centrum is extremely shallow in the vertical direction and correspondingly wide transversely ; the posterior interarticular facet, on the other hand, has more or less of a quadrilateral outline. All this holds true, especially in the leading cervicals, whereas in the last free dorsal vertebra, both anterior and posterior facets are strictly of a quadrilateral outline. They are "heterocœlous" throughout the spine, with the exception of the atlas, which is, of course, procœlous anteriorly, with its posterior face, slightly convex.

The coössified vertebral piece of the dorsum, composed, as I have said, of four vertebræ, presents some few additional characters worthy of our notice. Ragged metapophyses are developed in the usual way at the extremities of the transverse processes, but they do not reach either far enough forwards or backwards to bring the several vertebræ in contact at these points. Vacuities exist at either side of the low neural crest, where the fused articulations of the pre- and postzygapophyses are found. They are larger posteriorly than anteriorly, and admit of a view of the neural canal through them. Viewing this piece upon lateral aspect, the several facets for the ribs are seen to be very distinct, especially those for the capitula, where the edges are raised and prominent, thus forming a decided concavity for the head of the rib. On the other side, and immediately anterior to any one of these facets on the centrum of the vertebra is seen a large subcircular vacuity. It opens directly, in every instance, into the spinal canal, and is directly opposite the corresponding opening of the other side of the bone. A similar pair is formed when the last free dorsal vertebra is articulated *in situ*, and it is seen to be formed by the meeting of the zygapophysial processes laterally and above, and by the centra below. These centra of this fused piece are deep, and markedly compressed in the transverse direction, with an infero-median longitudinal sharpened border, which terminates in front on the apex of the second or last hyapophysis.

As to the *ribs* of this Flamingo, there may be a thoroughly rudimentary pair on the 18th vertebra, or the riblet may be free upon only one side of the same. There are four pairs of well-developed ribs, however, that come from the coössified dorsal vertebral piece; a pair from the vertebra that follows it; and finally there is a pelvic pair. All of these are connected with the sternum by means of costal ribs, and behind the pelvic pair, articulating neither above nor below, is a very delicate pair of so-called "floating ribs." Both costal and thoracic ribs are completely pneumatic, and exhibit some notable peculiarities. If we take the anterior pair that come from the first vertebra of the dorsal piece, we find that either one of them is greatly compressed in the antero-posterior direction between the head and the tubercle, while the "body" of the bone is similarly much flattened in the reverse direction. The unciform processes are simply elongated swellings on the side of the shaft, and the part of the bone above them is much expanded, the expansion being directed entirely

forwards and on its mesial aspect are seen the pneumatic foramina. This peculiar expansion becomes much less as we pass through the series in the direction of the pelvis, but is never entirely lost; while on the other hand the unciform processes become enormously elongated and widened, being anchylosed to the ribs. But these again in turn are a little less conspicuous as we approach the pelvis, and the pelvic pair of ribs are without them entirely. The *costal ribs* are slender and flattened, and not much curved, with the exception of the ultimate pair, and even they do not show it as much for their lengths, as in some other birds. Measuring the chord of one of these last, it is seen to be 6.3 cm. long, while the length of one of the first pair is not more than 1.7 cm.

The *pelvis* of *Phœnicopterus* is inclined to be rather narrow, or at least moderately so, and deep in the vertical direction. Viewed upon its dorsal aspect, the superficial area of the preacetabular region is about equal to the postacetabular, but the latter is nearly flat in character, while the sides of the former are somewhat concave, and face far more outwardly than upwardly. The long, median axis of the sacrum is almost a straight line. Anteriorly, the borders of the ilia are much rounded, jagged in character, emarginated, and these bones here overarch the first sacral vertebra, to a considerable degree. A double row of intervertebral vacuities are present, the first half dozen pairs being all more or less of a size, but posterior to them, the last two sacral vertebræ become far more individualized—the ultimate one being very distinctly so, projecting as it does beyond the iliac bones posteriorly.

In the preacetabular region the mesial margins of the ilia meet over the top of the sacral crista only at their middle points, and these bones in this locality are completely fused with the sacrum—the ilio-neural canals being thus thoroughly covered over, and sealed up both in front and behind. As these iliac borders sweep round in the direction of the acetabulum upon either side, they are seen to be roughly sharpened and rather prominent. Over either ilio-ischiac foramen the ilium is seen to jut out in the horizontal plane, thus forming an overhanging ledge above that vacuity, of a fairly well-marked character. Below, as well as in front of this projection, and especially above and in front of the cotyloid ring, the bone is wrinkled, and puckered, and pitted, the various little concavities thus formed harboring at their bases the pneumatic foramina that lead into the internal tissue of the pelvis. On

lateral aspect, the acetabular ring is seen to be large, nearly circular in outline, with raised antero-external margin. The antitrochanter is also conspicuously developed. Behind it is the very extensive opening of the ilio-ischiac foramen, which in this species is so broadly elliptical in outline, as to appear more than usually circular—its minor axis being about three-fourths the length of the major one. Posterior to this foramen the side of the pelvis is both deep and smooth, with but the barest suspicion of an ilio-ischiac notch in its hinder margin. The "obturator foramen" and the "obturator space" have practically merged into one, there being barely an osseous isthmus dividing them. The latter is very large owing to the deep downward sweep of the pubic bone, and the concavity of the inferior margin of the ischium. The *pubis* is long, narrow and slender, being nearly of uniform width throughout. It projects nearly two centimeters beyond the ischium behind, and its extreme tip is slightly spatulate and decurved.

Ventrally, we are to notice that the first sacral vertebra, though considerably larger than any of the others, is still smaller than the last free dorsal one, and has many of its characters, notwithstanding its complete fusion with the remaining vertebræ of the sacrum and with the ilia. The four that succeed it throw out their lateral processes to the under surface of the ilium on either side, to completely coössify there with those bones, or, as in the case of the last two of these four, to press closely against them. After these there next abruptly follows the deep concavity of the pelvic basin, showing, in either one of its lateral walls, the very circular and smooth internal ring of the acetabulum, and the large ischiac foramen. These are separated by a strong, though narrow osseous isthmus, the upper part of which, upon either side, serves as an abutment against which rest the outer expanded extremities of the produced parapophyses of what are really the two true sacral vertebræ. The next four sacral vertebræ have their lateral processes elevated, with their dilated outer ends abutting against the mesial margins of the ilia, but in the case of the last two of these no anchylosis takes place where they meet. As already explained, the ultimate sacral vertebra projects beyond the iliac bones behind. (See Plate XIII., Fig. 7.)

Within the pelvic basin small groups of pneumatic foramina occur in various places, and a strongly-marked rounded ridge passes longitudinally over about the site of the original line of meeting of the ilium and ischium of either side. The pubic bones are nowhere in con-

tact with the latter except at their commencements in the acetabular rings.

With respect to the *six* free *caudal vertebræ* and *pygostyle* we are to notice that from first to last they gradually decrease in size, and that the lateral processes also become progressively shorter and shorter to be entirely absent in the two last vertebræ and the pygostyle. The neural canal very small at the commencement likewise becomes rapidly reduced in calibre, though it persists as far as the pygostyle, into which it penetrates for a short distance. All the neurapophyses are very low, thick and stumpy, and exhibit a feeble tendency to bifurcate in front. It is only the last two caudals and the terminal piece that develop hæmal spines, and these are short and pointed, being on the antero-inferior margin of the centrums, and are directed forwards to underlap the vertebra next in front of them. The zygapophyses are aborted, unless it be that the minute bifurcations spoken of above as appearing on the anterior part of the neural spines, represent the rudiments of prezygapophyses, which indeed they may. Each centrum is procœlian in character, and a hæmal canal is absent. In the mounted skeleton of *P. antiquorum* (see Plate IX.), in the collections of the U. S. National Museum, the ultimate "uro-sacral" is not fused with the others, so in this specimen it may be considered as more properly belonging to the tail vertebræ, thus making *seven* instead of *six* of those bones, as I have stated above for *P. rubra*. A similar variation is sometimes formed among the *Anseres*, where, too, the usual number of caudal vertebræ appears to be six or seven. In the same specimen there is also a striking difference in the ribs from those of *P. rubra*, for the pelvic pleurapophyses have semi-aborted epipleural processes upon them, and there is a pair of elongated, free "cervical ribs," which lack them altogether.

Of the Sternum and Shoulder-girdle.—Unlike the *sternum* of the Ibises of the genus *Plegadis*, this bone in the Flamingo is, behind, but once deeply notched upon either side of the carina—and in this respect it agrees with the sternum as found in all typical Geese and Swans, and also in many Ducks. The style of the notching, however, is more as we find it among the Geese of the genus *Bernicla*, only in the latter the lateral xiphoidal processes are longer than the body of the sternum, are more curved, and have their extremities somewhat dilated; the mid-xiphoidal process is likewise broader in the sternum of the Goose, and its postero-lateral angles are produced. In *Tantalus* the "notching" of the sternum agrees with the Flamingo.

In its general form the sternum of *Phœnicopterus* is oblong, being somewhat wider in front than it is behind. The six hæmapophysial facettes upon either costal border occupy less than half the length of the same. Dorsally, the sternal body is profoundly concave, and a scattered row of small circular pneumatic foramina occur down the median line upon this aspect. In front, the border of the bone is greatly arched, the convexity being directed anteriorly. There, too, we find in the middle line a broad concave notch, while laterally, the "costal processes" are subtriangular in form, and by no means conspicuously developed.

The carina is deep and occupies the entire length of the bone, sloping gradually away posteriorly, while its thickened anterior border is concave, and its inferior one moderately convex. The carinal angle is more rounded off than we usually see it in the *Anseres*. On the ventral aspect of the sternal body we observe that the pectoral muscular line runs to the *middle* of the base of the keel, while in most *Anseres* this line runs the entire length of the sternal body to the termination of the carina behind. This in each case also applies, of course, to the muscular line on the lateral aspect of the keel, which always joins at a rounded angle posteriorly the pectoral muscular line of the ventral surface of the sternal body. The deep *coracoidal grooves* of the sternum of *Phœnicopterus* decussate mesially as they do in *Plegadis* and *Tantalus*, which is not the case in the *Anseres* in so far as I have examined them. There is also present in the Flamingo a large *manubrial process* of the typical trihedral form. This apophysis is also seen at the fore part of the sternum of *Bernicla canadensis*, where it is comparatively smaller and varies somewhat in shape in different individuals of this species. It is entirely absent in the Canvas-back Duck (*Aythya vallisneria*), and more or less aborted in some Ibises, as, for example, *Plegadis*.

Regarded as a whole, the sternum of *Phœnicopterus ruber* presents us with as many genuine ibidine characters as it does with anserine ones, thus sustaining a fact so evident in other parts of the skeleton of this remarkable bird. In some respects it may be said, however, that the bone offers us characters which call to mind the ciconine sternum (*Tantalus*), as for example, it being two-notched instead of four-notched as in *Plegadis*, though this may mean anserine affinity apart from any kinship the Flamingo has with the Storks.

Judging from the bones of the shoulder-girdle we are strongly

inclined to believe this to be the case. These latter will now be considered.

Upon comparing the *os furcula* of *Phœnicopterus* with that bone as we find it in the *Anseres* and in various species of Ibises, I find it to be decidedly more anserine in character that ibidine. Indeed, the fourchette of our Flamingo may very well answer for that bone in any average Duck of medium size, and in its general characters it departs but little from the os furcula of *Bernicla*. It is of the typical broad U-shaped pattern, with a semi-aborted, stumpy hypocleidium at the posterior aspect of the symphysis. The latter feature is usually absent among the *Anseres*, and rarely if ever present on the bone as found among ordinary Ibises. Viewed upon lateral aspect it will be seen that it is markedly curved in the antero-posterior direction, the convexity being to the front; and that the clavicular limbs as well as the symphysial arc of the arch are nearly of uniform calibre. The former is somewhat compressed in the transverse direction and the latter antero-posterior-wise. Each free clavicular extremity is considerably drawn out and very gradually terminates in a blunt point behind. On the upper side of either clavicle, at about 1.5 cm. anterior to the blunt posterior apex, we are to observe the barest evidence of a minute tubercular elevation; it is no more conspicuous than we see it in such a genus of Geese as *Bernicla*, but in some ducks this process is a very well pronounced character, as it is also in some Mergansers. The os furcula of *Phœnicopterus ruber* is non-pneumatic, and, although its coracoids and scapulæ present all the usual appearances of bones that enjoy that condition, I have failed to find any foramina in the latter, and they are very small in the former. They occur in an unusual place in the coracoids as we shall presently see.

Upon comparing the *coracoid* of the Flamingo with that bone as it is found in various Ducks, Geese, Swans and Ibises, I find it to be most like the coracoid of such a Goose as *Bernicla canadensis;* it, however, offers some characters which readily distinguish it from that bone. In the first place it is somewhat shorter and rather stouter; then also its scapular process is longer and more curved, and is perforated at its base by the elliptical foramen seen in many birds. This foramen is present in *Plegadis*, where it is very small. On the inner aspect of this foramen in the Flamingo (on the shaft side) the bone has been absorbed so as to create a pneumatic aperture of some considerable size—the opening being as large as the perforating foramen itself.

From its hidden position, however, this pneumatic foramen is not likely to be observed upon casual observation.

The sternal expansion of the coracoid is very broad, being compressed in the antero posterior direction with a very large facet upon its hinder aspect just as we find it in *Bernicla*. The "lateral process," however, is rather more conspicuous in the Flamingo than it is in the Goose, and the internal process is at the same time more pointed. The summit of the bone is tuberous and enlarged, and the shallow glenoid cavity extensive. A deep, circumscribed fossa is seen for the accommodation of the head of the scapula—a character which is also present in the coracoid of *Bernicla*. Minute spinous processes are found upon the lower interno-mesial border of the shaft, which are but very faintly developed in *Bernicla*, though in the latter, on the posterior aspect of the bone, the muscular lines of which these processes are the mesial extension, are very much better marked than they are in the Flamingo. *Phœnicopterus* possesses a comparatively long *scapula* of the usual ornithic pattern. Its clavicular apophysis is produced well forwards, and the blade of the bone is curved in both vertical and lateral directions. Posteriorly it is *gradually* drawn out to a point, thus differing from the scapula of *Bernicla* wherein the hinder end of the bone is squarely truncated, or from *Plegadis*, wherein it is seen to be obliquely truncated. Measuring the chord extending from the apex of its clavicular process to the posterior tip of the bone we find it to be 9.4 cm. Unfortunately, in the sole specimen I have in hand for description, the ossifications of the air-passages, as the trachea, etc., are all missing, not having been preserved by the person who prepared it, therefore I can give no account of them at this writing. The bones of the hyoidean apparatus have also been lost, as have likewise the ossifications of the organs of special sense.

Of the Appendicular Skeleton.—Here too, apparently, a few of the small bones are missing, having been lost at the same time with the others mentioned in the last paragraph—for I have no first metatarsals, which the Flamingo undoubtedly possesses, and the ends of the finger-joints of the pollices appear to terminate in minute articular surfaces, leading one to suppose that those joints supported terminal claws. As far as my material goes the skeleton of the limbs offers the following bones for examination. In the *pectoral extremity*—a humerus, the radius and ulna; two free segments in the carpus; the carpo-metatarsus; the phalanx of pollex; the two joints of index; and the very

small joint of the medius digit. In the *pelvic extremity*, there is found the femur; a patella; the tibio-tarsus and fibula; the tarso-metatarsus; and a foot composed of joints arranged on the plan of 2, 3, 4 and 5 joints to the first, second, third and fourth toes respectively.

In the pectoral limb the humerus is the only bone that enjoys a condition of pneumaticity, as is the femur the only one in the pelvic limb. With respect to the humerus the pneumatic foramina are very small indeed and scattered, being found in the shallow pneumatic fossa, and a few in the incisura capitis near the humeral head. In the femur they are very much larger and are found, as usual, on the anterior aspect of the bone just below the crest of the trochanter major. Apart from being somewhat longer and larger, the *humerus* of *P. ruber* is very like the humerus of *Bernicla canadensis*. It presents, though not to a very marked degree, the usual sigmoidal curvings of the shaft and extremities; the former being smooth and subcylindrical in shape. The "radial crest" is long and not very lofty, it being relatively higher in *Plegadis*, shorter, and more rounded. "Incisura capitis" is deep, and well separates the ellipsoidal humeral head from the tuberculum internum. The apex of this latter is flat in the Flamingo, whereas the tuberculum externum is rounded. The very reverse of these conditions obtain in *Bernicla; Plegadis* has both of these tuberosities, not flat, but slightly concaved. Again, as I have already pointed out, the pneumatic fossa in *Phœnicopterus* is shallow, and the foramina small and scattered. In the goose the fossa is also shallow. but the single air-hole is unusually large, deep, open, and more or less elliptical in outline. Both in the Ibis and in *Bernicla* we find a small nutrient foramen near the middle of the humeral shaft; this character is absent in the humerus of the specimen of *Phœnicopterus* at hand. At the distal extremity of the bone, the usual fossa found above the trochlear tubercles on the palmar aspect of the shaft is well marked and individualized in both Flamingo and *Bernicla*, but not so in *Plegadis*, where only a shallow, general concavity occupies the same site. Indeed, the characters found at this end of the humerus are quite the same in both the Flamingo and the Goose, with but one exception, for in the latter we meet with a well-marked circumscribed fossa of no great size, just above the trochlea ulnaris on the anconal aspect of the bone, which is not evident in the former nor in *Plegadis*. In *P. ruber* the humerus has a length of about 18.8 centimeters in the adult.

Neither the *ulna* nor the *radius* offer us with any unusual characters beyond what we find in the bones among the larger-sized waders. Each is slightly bowed from end to end along the continuity of the shaft; particularly is this true of the radius, where the character is pretty strongly marked. This latter bone is somewhat peculiar in having its entire shaft very much flattened upon its entire anconal surface, a feature not especially noticeable in either *Bernicla* or *Plegadis*. On the shaft of the ulna the row of tubercles for the quill butts of the secondary feathers, so conspicuous in many birds, are here apparently quite absent.

The *chord* of the radius has a length of about 19.8 centimeters, and the ulna measures a few millimeters more than 20. In the wrist the two usual carpal elements of the Flamingo present the common ornithic characters, and these depart hardly at all from the corresponding ones as we find them in the *ulnare* and *radiale* in the *carpus* of *Bernicla*. I have compared these two birds, articular facet for articular facet, border for border, fossa for fossa, and in general form I find them to be almost identically alike. In speaking of the skeleton of the pectoral limb of *Phœnicopterus ignipalliatus*, Parker has said "On the whole, this is a very perfectly formed wing, and is more like that of an Ibis than that of a Goose, as, indeed, is much of the structure of *Phœnicopterus*.[1] At one time I was inclined to concur in this opinion, but upon carefully comparing the skeleton of manus in *P. ruber*, *Bernicla canadensis* and in *Plegadis guaranna*, my former view of the subject has somewhat changed, modified as it has been by the examination of better material.

P. ruber has a *carpo-metacarpus* that measures about 9.5 cm. in extreme length, whereas that bone in *B. canadensis* usually measures a little less than 9 cm. In the Flamingo the long axis of the first metacarpal makes but a very slight angle with the long axis of the second or index metacarpal; in the Goose the same angle is more obtuse. In this little point the Flamingo and the Ibis agree, but in the Ibis the shaft of the third metacarpal is obviously bowed, while in both Goose and Flamingo it is nearly parallel with the shaft of the second metacarpal. At the distal extremity of the bone the fusion between the shafts of the second and third metacarpal extends further proximad in *Phœnicopterus* than it does in either *Bernicla* or *Plegadis*, and I observe this is also true of *P. ignipalliatus*, judging from Parker's figure in the article

[1] Ibis, April, 1889, p. 185. Science, Vol. XIV, No. 347, pp. 224, 225.

quoted above. That eminent authority in the same place invites attention to the rudiment of a fourth metacarpal in this bird, it being a mere tubercle situated at the proximal extremity of the third metacarpal on the palmar side of the bone. I find it also in *P. ruber*, but it appears to be absent in Geese and Ibises. Before I am quite satisfied, however, that this is the correct determination of this not very conspicuous tuberosity, I must have examined embryo Flamingoes at various stages of their growth.

The process called by Parker the "first distal carpal" is strongly developed, not only in *P. ruber*, but likewise in both Geese and Ibises. In all these birds the shaft of the second metacarpal is very straight and rather stout, being at the same time flat upon the anterior surface; it has about the same length as the third metacarpal. In *P. ruber* the proximal joint of pollex is long, much compressed from side to side, with a sharp anterior border. Professor Parker found that in *P. ignipalliatus* it supported distally a large claw, and I think very likely this also obtains in *P. ruber*, but it has been lost in my specimen.

In the case of the proximal joint of the index digit, aside from the fact that the bone is longer and more narrow in the Flamingo than it is in *B. canadensis*, they have precisely the same characters. Both have the dilated part of this joint very nearly flat, somewhat thickened and quite smooth upon either side. In *Plegadis*, however, it is very thin indeed, and distinctly divided into two fossæ by a thicker ridge of bone.

The second joint of index has much the same form as the digit of pollex but it is longer and somewhat twisted. It is probable that it supports distally a small claw, but it is, during life, enveloped in the skin, instead of being encased in a true horny theca, as in the case of the claw of pollex. This phalanx in *Bernicla*, that is the second one of index, develops proximally upon its antero-lateral border a very deep little tendinal groove, that comes very near being a closed canal; this character is not seen either in Flamingoes or in *Plegadis*. Finally, the phalanx of the third finger is short and small, being slightly curved, and when articulated *in situ* is closely pressed against the ulnar border of the expanded part of the proximal joint of index.

On the whole, there is a preponderance of the anserine characters in the skeleton of the wing of a Flamingo over the ibidine ones, but the excess is by no means very great..

Of the Pelvic Limb.—This species of Flamingo has, comparatively speaking, a short and very bulky *femur*. Owing to its high pneumatic condition, the dried bone is extremely light. It measures in total length 9.1 cm., while a femur of *Bernicla canadensis* I find to be 7.8 cm. long, and that of *Plegadis guarauna* 5.2 centimeters. The trochanter major is conspicuously developed, being broad externally, where it is powerfully marked by muscular lines and depressions, while antero-internally it curls upwards and forwards so as to be reared above the extensive articular surface on the summit of the bone. The globular femoral head is large, markedly sessile, with the diffuse excavation for the round ligament quite shallow. Turning to *Bernicla* we at once see that the proximal end of the femur is very different from this, for the caput femoris is relatively smaller, and the fossa for the ligamentum teres even less deep; indeed, so shallow as hardly to attract attention at all. But a still greater difference is seen in the trochanter major, for in this Goose that process is a quite inconspicuous feature, not rising above the summit of the bone, and being but very slightly produced anteriorly. In *Plegadis* the trochanter major is sharp and thin-edged, and by no means well-developed—in fact the femur of this Ibis differs very considerably from that of the Flamingo in most of its characters. Passing to the shaft of the bone in *Phœnicopterus* we find it to be nearly *cylindrical* and straight, with the surface exhibiting a peculiar roughness, and the chief muscular lines powerfully marked. Especially is this latter the case on the posterior aspect where they run down to the internal condyle. At the distal end, the condylar protuberances are particularly massive and bulky, with their anterior crests conspicuously developed, wide apart, and nearly parallel to each other. All this gives a spacious "rotular channel," which below merges into the intercondyloid fossa. The long axes of the anterior condylar crests each make an angle with the long axis of the shaft. These angles are very nearly of the same aperture, owing as we have said, to the crests being nearly parallel, and they open, widely obtuse, internally. In other words, when the femur is articulated *in situ*, the condylar end of the bone exhibits a *bending towards* the mesial plane of the trunk. The external condyle has double the bulk of the internal one, is lower on the shaft, and presents an immense fibular cleft posteriorly with its inner part greatly produced backwards. Comparatively speaking, the popliteal depression is not so well marked as it is in *Bernicla*, there being scarcely

any excavation at all. Posteriorly, in the case of the Flamingo, the external condyle comes up higher on the shaft than the smaller internal ones, while in the Goose their extension in this respect is about equal. At the usual sites we observe that the pits into which the ends of various tendons and ligaments are inserted during the life of the individual, are circumscribed, and very distinctly marked.

A good sized *patella* is present in the pelvic limb of *Phœnicopterus*, it being nearly a centimeter and a half long, and about half as wide. It is roughened on its antero-convex surface, but quite smooth upon its postero-concave aspect. These sesamoids are thoroughly independent of any connection with the tibio-tarsus of either side, being simply encased in the tendon of the great extensor muscle of the leg, in the usual manner.

The nearly straight *tibio-tarsus* is of great length, measuring fully 33.5 cm. The summit of the bone is but slightly excavated for the internal condyle of the femur, while the facet for the external condyle is convex, oval in outline, and situated at the external angle of the head of the bone. When the shaft is held in the vertical position, this facet looks upwards, outwards, and slightly backwards. The cnemial crest rises somewhat above the tibio-tarsal summit, being composed chiefly of the procnemial process, which is large, oval, with its upper part bent abruptly over to the outer side, while below it is not at all extended down upon the shaft, from which it is produced directly forwards. On the other hand, the ectocnemial process is produced directly outwards ; is smaller than the procnemial, triangular in outline, and terminates in a blunted angle externally. It also fails to be at all produced down upon the shaft of the bone. The fibular ridge is comparatively short, and but slightly produced. For its proximal third, the shaft of the tibio-tarsus is somewhat antero-posteriorly compressed, the surfaces being smooth. As we pass to the middle and lower thirds of the bone, however, it becomes more or less oblong upon horizontal section—the sides being flat, and the anterior and posterior surfaces more or less longitudinally grooved, especially the former. At the distal end we find the tibio-tarsal condyles, which are here reniform in outline, each being antero-posteriorly elongated, and slightly farther apart in front than they are behind. They project a little in the latter situation, and considerably so in the former, where they are thicker from side to side than they are elsewhere. The intercondyloid excavation is profound anteriorly, shallow below, and

deepens a little again behind. Above this intercondyloid concavity in front we meet with a distinct projecting abutment, supporting a small subcircular facette upon its lower aspect. This projection prevents the bending of the tarso-metatarsus upon the tibio-tarsus beyond a certain angle. This angle is about equal to a right angle, and when the two bones mentioned are brought to that position, being at the same time normally articulated, the mid-anterior process on the summit of the tarso-metatarsus comes in contact with the aforesaid facetted projection, and a further bending in that direction is prevented. To the inner side of this projection, we find the usual osseous bridge spanning the tendinal canal. The span is broad and thick, and the tendinal passage created by it of no very great calibre.

The *fibula* is perfectly free from the tibio-tarsus, measuring in length but a little more than one-third of that bone. As is so commonly the case among birds, it simply makes articulation with it along the fibular ridge, being held in its position during life by means of a ligamentous attachment. Its proximal moiety is stout and rather bulky, especially its head, from which latter part it tapers gradually to its free distal end ; its lower third being markedly slender and of small calibre. The summit of the fibula is moderately compressed from side to side, and rather elongate in the opposite direction, thus giving to its articular surface on top an oblong outline. At the outer side of its shaft a well-marked pit with raised margins indicates the point of insertion of the biceps muscle. It is nearly opposite the middle of the long, narrow articular line found on the inner border of the bone, intended for articulation with the fibular crest of the tibio-tarsus.

Both in *Bernicla* and *Plegadis* the lower end of the fibula fuses with the shaft of the tibia ; more particularly is this the case in the latter genus, than in the Goose, where the fusion is less firm. And this leads me to say that I see more points of resemblance, in other ways, however, between the bones of the leg of the Flamingo and *Plegadis guarauna*, than I do between the former and *Bernicla canadensis*. The projecting apophysis with its facet, which occurs anteriorly above the intercondyloid fossa of the tibio-tarsus, described above for *Phœnicopterus* is present in the Ibis but entirely absent in the Goose.

The *tarso-metatarsus* of *P. ruber* lacks but a little (2.2 cm.) of being as long as the tibio-tarsus. For the most part its shaft is nearly

straight, and it is only at the proximal third that a very slight curving backwards is to be noticed. The anterior surface of the shaft is strongly grooved in the longitudinal direction for its entire length ; this is also the case on the hinder aspect, but here it does not commence for at least two centimeters below the hypotarsus, and gradually dies out, for a little more than that distance above the trochlea. Laterally, either side of the shaft is flat and quite smooth.

Passing to the proximal end of the bone, we find on the summit two deep, subelliptical excavations, well separated mesially, for the reception of the condyles of the tibio-tarsus. In front, and standing directly between these on the anterior margin is the usual intercondyloid process—here more than commonly conspicuous. Below this, anteriorly, the proximal beginning of the shaft is somewhat excavated, and this concavity harbors a double tubercle for the insertion of the tibialis anticus. Above these are two foraminal perforations, which pass to emerge one upon either side of the hypotarsus behind—the outer one being considerably larger than the inner one. Their course is oblique from above downwards. The hypotarsal process is very pronounced, but does not extend down upon the shaft behind. It consists of two oblong plates, placed vertically as usual, with a wide, deep passage between them for the accommodation of the tendons at the back of the bone. Three trochlear processes are found at the distal end of the shaft, and they are all well developed. The middle one, which is very large, is the lowest one on the shaft—the outer one next, and the inner one is highest of all. The outer and inner ones are produced well backwards, especially the inner one, which holds in the main a decidedly posterior position. A deep notch separates the middle and outer one, and above this notch, in the longitudinal groove there found, is the single, and large antero-posterior perforating foramen for the anterior tibial artery. Very feebly marked indeed is the articular facet, for the articulation of the free, first metatarsal. Indeed, in the Flamingo, as in the Ibises, the latter is simply hung to the bone by means of ligamentous attachments, without making any true articulation, as it does in so many other groups of birds.

Swans, Ducks, and Geese have, in so far as I have examined them, a very different tarso-metatarsal bone from the one I have just described for *P. ruber*. Upon comparing the latter, however, with the tarso-metatarsus of *Bernicla canadensis*, we find that the trochlear processes at the distal extremities resemble each other in some particulars, but

not in all. On the other hand, when we come to compare the tarso-metatarsus of *Plegadis* with the corresponding bone of the skeleton in the Flamingo, we find the agreement of characters to be greater in number than in the case of the Goose. In each the form of the hypotarsus is essentially upon the same plan, as is the summit of the bone and the articular depressions found there. At the distal ends, the trochlear processes are more or less alike also, but in the Ibis there are two perforations, one above the other, for the passage of vessels (and nerves?) to the sole of the foot. The lower opening of the more distal one of these is to be found at the base of the notch that separates the middle and outer trochlear projections.

The foot of the Flamingo has the usual four fully developed toes, and they possess from hallux to the outer one 2, 3, 4, 5 joints respectively. The basal phalanx of the hallux is inclined to be slender as we find it in many Ducks and Geese; while the basal phalanges of the three anterior toes, are very much stouter and stronger, the middle one having a length in the foot of the individual I am examining of 4.9 centimeters. In the outer toe the three joints following the basal one are small, for the most part short and weak, the ungual phalanx of this toe being more compressed than they are seen to be in the middle and minor toes where they are short and decidedly stumpy. The ungual claw of the hallux is considerably longer, being at the same time distally pointed, and very nearly straight. The second and third joints of the middle toe are stout and have the appearance of being somewhat compressed from above downwards, especially at their distal ends. The second measures but 2 centimeters in height, and the third one is just half as long. Coming to the *inner toe* we find its basal and second joints to be well proportioned, being neither specially short, nor long, nor stout, nor slender; the second one measures more than half the length of the basal one, while their extremities are enlarged and present us with the usual form of articular surfaces there found in those phalanges in the ordinary ornithic type of foot.

Now, for one to say whether this skeleton of the pes in *Phœnicopterus* is on the plan of structure of the Goose, or Ibis, is very difficult. The truth of the matter is it is neither one, nor the other, but probably has an extraction of both in it, and this has given it a particular facies quite its own. For my part, I am inclined to think there is considerably more Ibis in it than there is Goose, inasmuch as the tibio-tarsus and tarso-metatarsus of the Flamingo agree in characters far better with those

bones as we find them to occur in any ordinary Ibis, than they do with the corresponding parts of the skeleton of any anserine fowl at present known to me. Likewise it is a significant fact that the tarso-metatarsus of the Flamingo is so very like that bone in such a bird as *Tantalus loculator*, and this applies only in a very slightly less degree to the tibio-tarsi of those birds.

ON THE SYSTEMATIC POSITION OF THE FLAMINGOES.

From what has been said above in the course of my observations upon the Osteology of *Phœnicopterus*, the reader no doubt is prepared to hear what I have to say on the taxonomy of these birds. I take the Flamingoes primarily to form an independent group, or suborder, for which the name ODONTOGLOSSÆ may be retained. This group corresponds exactly with Huxley's *Amphimorphæ*, and I believe Huxley was perfectly right when he decided that this was an intermediate group standing between the anserine fowls upon the one hand and the pelargo-ibine assemblage of forms on the other. Among the *Anseres* the Flamingo comes nearest to certain Geese than it does to the Swans, or some of the Ducks and Mergansers. To what existing genus of Ibis or Stork, however, it is more nearly allied I am not at present quite prepared to say, not having examined all the material necessary to come to a decision in the matter. The phœnicopterine stock may be pretty old; the present writer has described a Flamingo from the Equus beds of Oregon, and that tertiary fossil departed but very slightly from our existing *P. ruber*. Judging from its skeleton the Flamingo seems to borrow characters from a number of grallatorial forms, as the Spoonbills (Ajaja), the *Ibididæ*, and from *Tantalus*. If we take the genus *Ardea* as an example, however, I fail to find very much heron in the osteology of *P. ruber*, indeed, hardly any, and I am inclined to believe that it is pretty well removed from that stock among the *Herodiones*.

EXPLANATION OF PLATES.

PLATE IX.

Fig. 1. Skeleton of a Flamingo. (*Phœnicopterus antiquorum.*) Coll. U. S. National Museum, Washington, D. C., U. S. A. No. 14,407. (Much reduced.)

PLATE X.

Fig. 2. Right lateral view of the skull of the Flamingo. (*P. ruber.*) Natural size from a photograph by the author. No. 18,494. Coll. U. S. National Museum, Washington, D. C., U. S. A.

PLATE XI.

Fig. 3. Basal view of the skull of an American Flamingo. (*P. ruber.*) Natural size, from a photograph by the author. Spec. No. 18,494. Coll. U. S. National Museum. Mandible removed.

Fig. 4. Superior view of the mandible of American Flamingo. Photograph by the author. Natural size. From the same specimen shown in Pl. IX, Fig. 1, and in Fig. 3 of this Plate.

PLATE XII.

Fig. 5. Right lateral view of the four coössified dorsal vertebræ of the skeleton of the American Flamingo, as well as the same view of the last free dorsal vertebra. (*P. ruber.*) Natural size.

Fig. 6. Same view of the three (3) coössified dorsal vertebræ of *Grus Americana* (?) (Marked incorrectly *Grus canadensis.* No. 820 Coll. U. S. National Museum, Washington, D. C.) Both figures from photograph by the author. Natural size.

PLATE XIII.

Fig. 7. Dorsal view of the pelvis of the American Flamingo. (*P. ruber.*) Natural size, adult. (Photograph by the author). Spec. No. 18,494. Coll. U. S. National Museum.

PLATE XIV.

Fig. 8. Anterior view of the right coracoid of a Flamingo. (*P. ruber.*) No. 18,494. U. S. National Museum. Natural size.

Fig. 9. Antero-oblique view of the furculum of the same specimen.

Fig. 10. Anterior view of the left femur of the same specimen.

Fig. 11. Subdirect ventral view of the sternum of the same specimen. All figures are of natural size, and from photographs made by the author direct from the specimens.

X. DESCRIPTION OF A NEW SPECIES OF BAËNA (B. HATCHERI) FROM THE LARAMIE BEDS OF WYOMING.

By O. P. Hay.

Mr. J. B. Hatcher, Curator of the Department of Vertebrate Palæontology of the Carnegie Museum, has kindly placed in my hands, for examination and description, a specimen of the shell of a turtle which he collected in Wyoming in the year 1900. This shell was found in a sandstone belonging to the Laramie formation, in Converse County. An examination shows at once that it belongs to the genus Baëna, and that it is an undescribed species. The specimen is a fine one, both carapace and plastron being preserved, only a small portion of the left side of the rear of the carapace being absent. The shell has suffered some distortion, but not enough to interfere with a determination of the original form and of the elements entering into the structure. Finally, the specimen has been beautifully prepared by Mr. A. S. Coggeshall at the Carnegie Museum.

The genus Baëna has been known hitherto only from the Wasatch and Bridger beds of the Eocene, principally from the latter. This discovery made by Mr. Hatcher carries the genus back to the Upper Cretaceous, a matter of great interest.

Since the most distinctive characters of the species are found in the plastron, a plate is presented showing this portion of the shell. It is hoped that an opportunity will hereafter be found for publishing a more complete description and for making comparisons with other species of the genus.

The total length of the carapace has been 368 mm.; the greatest breadth, 280 mm.; the height, from the bottom of the plastron, about 145 mm. From the ends of the axis of greatest width, somewhat behind the inguinal notches, the carapace rounds rather rapidly to the median excavation behind. The front of the carapace is rather pointed. The hinder border is somewhat deeply scalloped, as in the other species of the genus.

The sutures between the various bones are fine, but most of them can be traced without much difficulty. The neurals are in general

hexagonal, with the anterior end somewhat, but not greatly, broader than the hinder end. The sixth neural is octagonal. There is a large pygal, but no postneural. The fifth costal plate is much narrowed at its distal end. The vertebral scutes are much broader than in any of the other species of the genus, the second having a width of 100 mm. and a length of 86 mm. A small accessory costal plate is cut off from the first vertebral on each side, making five costals on each side.

The plastron is rather narrow in front, and considerably narrower behind than in any other published species. The length is 305 mm. The bridge has a width, fore and aft, of 115 mm. The anterior lobe is 106 mm. long and 115 mm. wide at the base. The width diminishes from the base slowly at first, then rapidly to the midline; so that the front is rounded. The hinder lobe is 98 mm. long and 120 mm. wide at the base. The lateral borders are nearly straight and convergent to the femora-anal sulci, where the width is 71 mm. Behind these, for a short distance, the sides are parallel. The hinder border is somewhat excavated.

The interclavicle is oval and 48 mm. long. There are large mesoplastra, whose inner ends are 23 mm. wide; the outer ends, 60 mm. The gulars and the intergular sulci radiate from the same point on the front of the interclavicle. On each of the bridges there are four inframarginal scutes.

AMERICAN MUSEUM OF NATURAL HISTORY,
NEW YORK, May 25, 1901.

XI. THE JURASSIC DINOSAUR DEPOSITS NEAR CANYON CITY, COLORADO.

By J. B. Hatcher.

Notwithstanding the great wealth of certain, indeed of several, of our Mezozoic horizons in dinosaurian remains and the exceptional vigor with which the bringing together and study of dinosaur bones have been pursued for the last quarter of a century in this country by Marsh, Cope, Baur, Osborn, Williston and others, and for an even longer period, though under much less favorable conditions, by British and European paleontologists, yet we are still ignorant of the complete osteology of all but a few of the many proposed genera of dinosaurs, while of the phylogeny of the various genera and species of the different families we know absolutely nothing. This is the more remarkable considering the progress that has been made in mammalian paleontology, where in many families, as for instance the horses, camels, and titanotheres, nearly every step in their development has been traced and can be pointed out with as much precision as can the different stages in the perfection of the modern steam engine, electric motor, or other mechanical device wherein the forces of nature have been made to serve the uses of man. This disparity in the progress of these two closely related branches of vertebrate paleontology has not been due to a lack of interest in dinosaur remains as such, for many of these animals by reason of their remarkable size and grotesque form have from their earliest discovery inspired almost universal interest. The difficulty in placing and keeping our knowledge of dinosaurs abreast with that of mammals has been due rather to the vastly greater difficulties encountered in bringing together sufficiently complete collections from the various localities and horizons to permit of a comparative study of the different forms from each. These difficulties arise from the great size of the individual animal in many genera and species, from the scarcity of dinosaur remains in many horizons and from the difficult nature and great expense of the work necessary for collecting dinosaurs. Moreover dinosaur remains have as a rule been found only in essentially one horizon in the same formation at any given locality, and when found at different and widely separated locali-

ties in the same formation it has thus far been found quite difficult to establish definitely the relative positions of such horizons within the same formation.

On visiting the bone quarries near Canyon City, Colorado, made classic by the researches of the late Professors O. C. Marsh and E. D. Cope, in the spring of 1900 shortly after taking charge of the Department of Vertebrate Paleontology in the Carnegie Museum, the striking advantages presented by this locality not only for collecting the remains of dinosaurs, but for determining the exact stratigraphic position of the various skeletons both with reference to each other and to the underlying Trias and overlying Cretaceous formations were at once apparent.

Perhaps in no other locality is the geological section from the base of the Trias to the top of the Cretaceous more complete than in the canyon of Four Mile, or Oil Creek, from the entrance to Garden Park, some eight miles east by north of Canyon City to the mouth of that canyon where it opens into the valley of the Arkansas River and thence across the valley to the foothills on the south side of the river, on a line about midway between the towns of Canyon City and Florence. The geological section along this line is remarkably complete and exceptionally well displayed, so that in passing down Four Mile Creek through Garden Park and the somewhat rugged canyon through which the creek flows on its way from the Park to the valley of the Arkansas River and thence across the river valley to the hills back of Florence there may be seen a continuous section commencing below with the brick red Triassic sandstones which form so conspicuous a feature in the bluffs on the west side of Garden Park and terminating above in the yellowish brown Laramie sandstones and Denver Beds of Cross and Eldridge found capping the bluffs and lower foothills on the south side of the Arkansas River. A brief description of the more important horizons shown in this section may not be out of place.

THE TRIASSIC.

To the Trias I refer the red sandstones just alluded to as so conspicuous in Garden Park. I have placed these sandstones in the Trias rather than the Carboniferous on no direct paleontologic evidence, but rather on account of their general resemblance to the red sandstones, which in other places underlie the Jura, and have by common consent been considered as belonging to the Trias. Dr. Whitman Cross has

designated this series as the Fountain formation and referred it to the Carboniferous on the evidence afforded by certain fossils found in certain thin seams of limestone interstratified with a similar red sandstone found in the western part of Colorado. Thus far no fossils are known from the red sandstone of Garden Park, and until we have some direct evidence as to their age it would seem as well to correlate them with the "red beds" everywhere so abundant about the eastern slopes and outliers of the Rockies and which have of late been generally considered as of Triassic age. These sandstones dip very gently to the southeast and pass beneath the surface at a point a little above the southern entrance to Garden Park. In their lower members they are of a uniform brick red color, fine grained, and do not differ materially from the Triassic sandstones found everywhere flanking the main ranges of the Rockies as well as surrounding all the detached or isolated upthrusts belonging to the same great mountain system, except for a decrease at this locality in the quantity of gypsum or selenite which usually accompanies the Triassic red beds of the West. Toward the top these sandstones become much harder, and coarser, the color is not so deep a red and in places they pass, toward the summit, into a very hard coarse-grained sandstone or conglomerate of a brownish gray color. I have been unable to detect any unconformity between the Triassic sandstones and the overlying Jurassic rocks in this locality, although a careful search might reveal such.

THE JURASSIC.

Immediately overlying the red sandstones are a series of brown sandstones, shales and marls with occasional thin seams or lenses of limestone. They have an aggregate thickness of perhaps 450 feet and the whole is about equally divided between sandstones, and shales or marls. The entire series is here referred to the Jurassic on the evidence afforded by the dinosaur remains found in them. These remains are found in considerable abundance at several horizons and occur both in the sandstones and the shales, while the limestone layers above referred to are as a rule very rich in the remains of small fresh water gastropoda and from one horizon great numbers of Unio shells and casts have been obtained in one of the marl beds. These invertebrate remains have been described by Dr. C. A. White in Bulletin 29 of the U. S. G. S. Unfortunately like most fresh water invertebrates they afford little evidence as to the exact age of the deposits from which they were derived.

Marsh has called these beds the *Atlantosaurus beds*, while Cross several years later named the same series the *Morrison formation*, referring it to the Juratrias. There would seem to be little doubt that the entire series may be very properly referred to the Jurassic on the evidence of the dinosaurian remains which they contain, all of which so far as at present known pertain to Jurassic types rather than Triassic. The beds of sandstone, marl and shale are not continuous, so that a section taken at any given point showing the arrangement of the different components would vary greatly from another taken at a different though not far distant place. The ripple-marks, cross-bedding and discontinuity of the component strata, as well as the presence of fossil footprints and the character of the invertebrate and plant remains found in the beds, all bear evidence of the prevailing conditions attending the deposition of the materials. These conditions will be discussed later when we come to speak of the bone deposits which they contain.

The sandstones, shales and marls of the Jura may be seen in the enclosing walls on either side of the southern half of Garden Park, and in the cañon of the creek below the park, which affords several splendid sections between the mouth of the cañon and the southern entrance to the Park. In general the beds have a gentle southerly dip, but within the cañon this dip and the general sequence of the strata is frequently obscured by numerous local faults and landslides. At the mouth of the cañon about four miles distant from Canyon City the strata are inclined at a high angle and soon pass beneath the surface.

CRETACEOUS.

The Dakota Sandstones.—Conformably overlying the Jurassic deposits is a series of yellowish-brown or whitish sandstones with occasional layers of shale. These sandstones and shales so closely resemble the underlying Jurassic deposits both as regards their physical appearance and constituent parts that it is impossible to definitely separate the two series, and any line of demarcation between the two deposits must be considered as somewhat arbitrary. Cross has placed the thickness of the Jurassic or Morrison formation at 350 feet, while to the Dakota he assigns a thickness of 300 feet. This appears to the writer as placing the base of the Dakota somewhat too low in the series, and I think by allowing so great a thickness as 300 feet for the Dakota they would be made to include the upper and perhaps a second

Dinosaur horizon in which remains of dinosaurs belonging to Jurassic types are quite abundant. I have thought best to assign a thickness of 450 feet to the Jurassic at this locality while limiting the Dakota to the uppermost 200 feet of the sandstone and shale series.

The Dakota may be seen as a rather thick, heavily bedded light brown or white sandstone capping the small detached tables which rise above the summits of the bluffs on the west side of the creek at the southern end of Garden Park. These sandstones are also conspicuous in the cañon below the Park, where they form the uppermost part of the cañon walls and usually present a bold face with sheer escarpments often from fifty to one hundred feet in height. In places they are very rich in the impressions of fossil leaves, but so far as at present known they are remarkably destitute of all remains of animal life, though a careful and continued search will doubtless yet bring to light remains of the terrestrial animal life that must have lived in the immediate region during their deposition. At the mouth of the cañon the rocks of the Dakota are inclined at a considerable angle and disappear beneath the surface. The Dakota has been generally assumed to be of fresh water origin, though the evidence in favor of this view has been of a negative rather than a positive nature. For the most part the materials of which these beds are composed would seem to have been deposited in fresh water, but there has lately been discovered some very strong evidence in favor of the marine origin of at least a portion of the series. This will be referred to later when we come to discuss the fossil deposits of the underlying series of sandstones and shales.

The Benton Shales.—The close of the period which witnessed the deposition of the Dakota sandstones was accompanied by a marked change in the physical conditions that prevailed over this region, as is abundantly emphasized by the nature of the materials composing the rocks of the succeeding formation as well as by the character of the fossils which they contain. For a long period during the Jurassic and early Cretaceous the surface of this region was maintained at an elevation for the greater portion of the time at least slightly above sea level and the sandstones and shales were laid down along the shores of adjacent seas, over the bottoms of smaller bodies of water or along the courses and over the flood plains of running streams. That some such conditions as the above attended the deposition of the materials constituting the rocks of the Dakota and Jurassic formations is abun-

dantly evidenced by the frequent examples of cross-bedding and ripple-marked surfaces exhibited by the sandstones, by the want of continuity in the different strata, by the character of the invertebrate fauna, the character of the vertebrate fauna and by the manner in which the complete or dismembered skeletons and isolated bones of the latter have been entombed.

At the close of the Dakota this entire region was subjected to a greater subsidence and was uniformly covered by a great sea, save perhaps for a few small islands. Evidence of this subsidence and the ingress of the sea consequent upon it, is seen in the uniform nature of the several hundred feet of shales and limestones, with at this locality a rather meager marine fauna, which overlie the Dakota sandstones with apparent conformity and constitute the Benton shales or lower member of the Colorado formation. Toward the top these limestones and shales are replaced by a few feet of brown sandstones closely resembling in general appearances the Dakota sandstones, though separated from them by from 400 to 500 feet of marine shales and limestones. This stratum of Benton sandstone may be seen on the north side of a small bluff just below the mouth of Wilson Creek on the west side of Oil Creek where the wagon road from Canyon City to Garden Park passes around the end of a low hog-back about one-quarter of a mile below the mouth of the cañon. The softer shales and limestones of the Benton are here obscured by the secondary deposits in the narrow valley of Wilson Creek which at this point discharges into Oil Creek, or Four Mile, as the latter is locally more generally known. The valley of Wilson Creek for some distance above its mouth follows the strike of the inclined strata, and owing to the greater resistance to erosion offered by the Dakota sandstones and the very similar layer of brown sandstone just referred to as occurring at the top of the Benton the breadth of the valley of this creek is here determined by the total thickness of the more easily eroded Benton shales, along the upturned edge of which the stream has cut its channel, following the line of least resistance.

The Niobrara.—Immediately and conformably overlying the stratum of brown sandstone just mentioned as occurring at the top of the Benton series there is a bed of shale about twelve feet thick followed by about thirty feet of fine-grained (magnesian?) limestone. This limestone is much jointed and is divided into a number of different strata separated by thin seams of shale. This is one of the most continuous

and easily recognizable horizons in the entire section and its materials are utilized quite extensively for the manufacture of Portland cement, large mills having been erected for that purpose at Portland a few miles below Florence on the Arkansas River. These limestones are overlaid by several hundred feet of dark colored, friable, arenaceous shales which toward their summit assume a yellowish color and pass gradually into a stratum of rather soft, yellow chalk not unlike in general appearance the softer strata of the chalks of central and western Kansas. The entire series commencing with the twelve feet of shale immediately overlying the brown sandstone at the top of the Benton, including the limestone and superimposed shales and terminating with the chalks just mentioned, constitutes the Niobrara or upper member of the Colorado formation. They are all well shown in the hills to the west of the road which leads from Canyon City to Garden Park about a half mile below the mouth of Oil Creek cañon.

The Pierre Shales.—Conformably overlying the chalks are a series of usually quite soft, fine-grained and finely laminated shales of great thickness and with numerous large concretions and septaria quite similar in form and structure to those found so abundant in the Pierre shales farther north. These shales doubtless belong to the lower member of the Montana formation, and while no direct evidence was found as to their exact age, I have referred them to the Pierre. They are well shown in the abandoned railway cuts on the projected and partially constructed road from Canyon City to Cripple Creek, where it passes over the low divide between Oil Creek and Canyon City, as also in the bluffs south of the Arkansas River, where they are overlaid by a series of sandstones and shales in which are perhaps represented rocks belonging to both the Fox Hills, Laramie and Denver formations, though of the existence of the former I was not able to satisfy myself.

The Bone Quarries in the Jurassic at Garden Park.—Fossil bones were first discovered in the Jurassic of this locality by the family of Mr. M. P. Felch in 1876. Through the local and Denver newspapers the attention of Professor Marsh was called to the locality and in the spring of 1877 Mr. S. W. Williston was sent by Professor Marsh to Canyon City to investigate the alleged discoveries. Mr. Williston at once recognized the importance of the locality and nature of the contained animal remains and began immediately the unearthing of the dinosaurian fossils. The quarry opened by Dr. Williston was worked

for several years for Professor Marsh under the very careful and skillful supervision of Mr. M. P. Felch, who showed a marked degree of appreciation of the importance of the remains and met and overcame the many difficulties attending their disentombment in a most commendable manner. Shortly after Professor Marsh began his operations at this locality Professor Cope also became interested and sent collectors to the same field to make further investigations. Cope's collectors were successful in finding rich deposits of Dinosaur remains in the same locality, but at considerably higher horizons, and these were successfully worked by Professor Cope for a number of years. In 1884 all work at this locality was abandoned and nothing further was done here in the way of collecting dinosaurs for sixteen years. In the spring of 1900 the present writer visited the locality and inspected the

FIG. 1. North end of Marsh quarry. The man in the foreground is standing on the bed of the quarry just below the bone-bearing horizon. The man above is standing on the layer of sandstone above the one containing the dinosaurian remains.

abandoned quarries of Marsh and Cope as well as making some further examinations with a view to determining, if possible, the vertical distribution of dinosaur remains throughout the beds. After a very superficial examination it became apparent that there were several distinct fossil-bearing horizons and that this locality more than any other offered very superior advantages for securing materials which would be of exceptional value in tracing the development of the different dinosaurian genera, owing to the various horizons at which the fossils are to be found and the ease with which the relative position of these various horizons can be determined. With this end in view rather than for the sole purpose of obtaining dinosaur bones, steps were at once taken to reopen the old quarries so long abandoned and to establish new horizons.

THE MARSH QUARRY.

Under the above name the locality most worked by Professor Marsh is referred to and from it were secured all the skulls and several of the most complete skeletons of Jurassic dinosaurs figured and described by him. He only abandoned it after the expense necessary to operate it had become so great, through the amount of material to be removed from above the bone-bearing horizon, that it was deemed no longer profitable. Both Mr. Felch and Mr. Smith, who had last worked the quarry for Marsh, represented to the writer that bones were seemingly just as abundant at the close of operations as at any time during the progress of the work. After this assurance from these gentlemen I decided to reopen this quarry at once. I was further led to this decision by the fact that the bone-bearing horizon in the quarry lies in the trough of a basin-shaped lens of sandstone, the bottom of which evidently owes its configuration to its having been deposited in a rather deep excavation in the surface of the underlying clays, which then formed the bottom of some stream or other shallow body of water. This basin, enclosed by an impervious stratum of clay, caused the formation of a bog or bed of quicksand thus endangering the lives of such animals as chanced to wander that way. The position occupied by this lens of sandstone in reference to the surface of the underlying clays is shown in the photograph of the front of the quarry reproduced in Fig. 2. The work of reopening the quarry was commenced November 1, 1900, and the bone-bearing horizon was laid bare over a strip sixteen feet wide and running the entire length of the quarry, or about seventy feet. At the upper end fully twenty feet of rock had

to be removed consisting largely of very hard sandstone. Already much good material has been secured belonging for the most part to Morosaurus, Stegosaurus, and Allosaurus.

In this quarry the bones are for the most part found in a very hard layer of sandstone, though they occasionally extend down for a short distance into the underlying clays. The bone-bearing stratum is

FIG. 2. View of face of south end of Marsh quarry showing depressed nature of base of sandstone lens. Under the tarpaulin on the left may be seen boxes of fossils ready for shipment.

about 150 feet above the red Triassic sandstones and the quarry is located about eighty rods below the house of Mr. Felch at the entrance to Garden Park. It is on the east side of the dry gulch that puts into Oil Creek just below the bridge by which the wagon road crosses that stream and about 100 yards above the mouth of the gulch. About thirty feet below this is a second bone-bearing horizon, while in the rather thick layer of clay just below the sandstone of the Marsh quarry are thin seams of limestone with numerous fresh water gasteropods. Across the gulch and about 100 yards above the Marsh quarry, in a

layer of marl at a somewhat lower horizon, are abundant remains of Unios belonging to various species.

The position and manner in which many of the bones lie in this quarry would indicate that the animals to which they belonged lived and met their death in the immediate vicinity if not on the exact spot where they are now found. Moreover, the frequent examples of

FIG. 3. The "Nipple" from the north showing in the foreground the trench cut by Professor Cope in collecting Dinosaur remains.

ripple marks, cross-bedding and other characteristics already referred to bear evidence that this immediate region was the habitat of these animals during Jurassic times and that the sediments constituting the rocks were accumulated not over the bottom of a great inland sea or lake, but rather on the bottoms, along the shores and over the flood

plains of lakes and rivers situated in a slightly elevated and level rather than mountainous region.

About two hundred and fifty feet above the level of the Marsh quarry and on the same side of Oil Creek, but three quarters of a mile distant from the Marsh quarry there is a thick stratum of chocolate-colored shale best shown in a small rounded butte, locally known as the "Nipple." This butte stands on the crest of the bluff above Oil Creek and is shown in the photographs reproduced in Figs. 3 and 4. It is perhaps 30 ft. in height and is composed entirely of a homogeneous stratum of chocolate-

FIG. 4. View from near Cope quarry with the "Nipple" in the middle foreground and Cooper Mountain in the distance. Garden Park lies between the crest of the bluff, indicated by the line of trees on either side of the "Nipple," and Cooper Mountain in a depression about 600 feet below the "Nipple."

colored shale. This rests on a stratum of sandstone and is capped by another layer of sandstone as shown in the photographs. The base of this conical hill is about an acre in extent and everywhere about its base the remains of dinosaurs crop out in great abundance. Work has already been commenced at this locality and it is proposed to remove with plow and scraper this entire hill and thus lay bear the bone-bearing horizon over a large area.

About one quarter of a mile southwest of the "Nipple" near the top of this same thirty feet of chocolate-colored shale and just beneath a thick layer of white sandstone, which is generally placed as the base of the Dakota, is an old abandoned quarry worked by Messrs. Lucas and Russell for the late Professor Cope, and from which they recovered for him the beautiful skeleton of Camarasaurus now in the American Museum of Natural History in New York. This is a distinctly higher horizon than the one at the "Nipple." A view of the abandoned workings at this quarry may be seen in Fig. 5 where the light colored Dakota sandstones appear resting on the dark, chocolate-colored shales which bear the dinosaurian remains. Owing to the poor light in the deep trench leading to the quarry the shaly structure of the latter is not shown in the photograph.

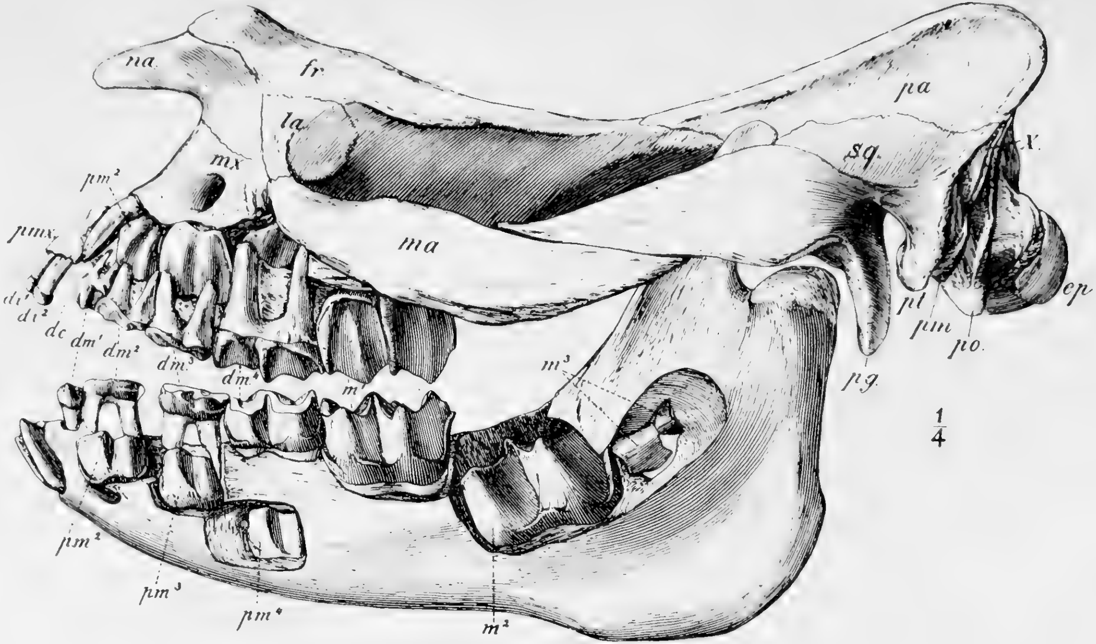
FIG. 5. Eastern entrance to Cope quarry. Light colored Dako'a sandstone at top underlaid by chocolate-colored shales with remains of Camarasaurus.

A number of other bone-bearing horizons have been detected, but as yet they have not been sufficiently prospected to determine their richness. Heretofore the entire series and the succeeding Dakota formation has been considered as of fresh water origin. But on his last visit to this locality the writer discovered casts of shells of Ino-

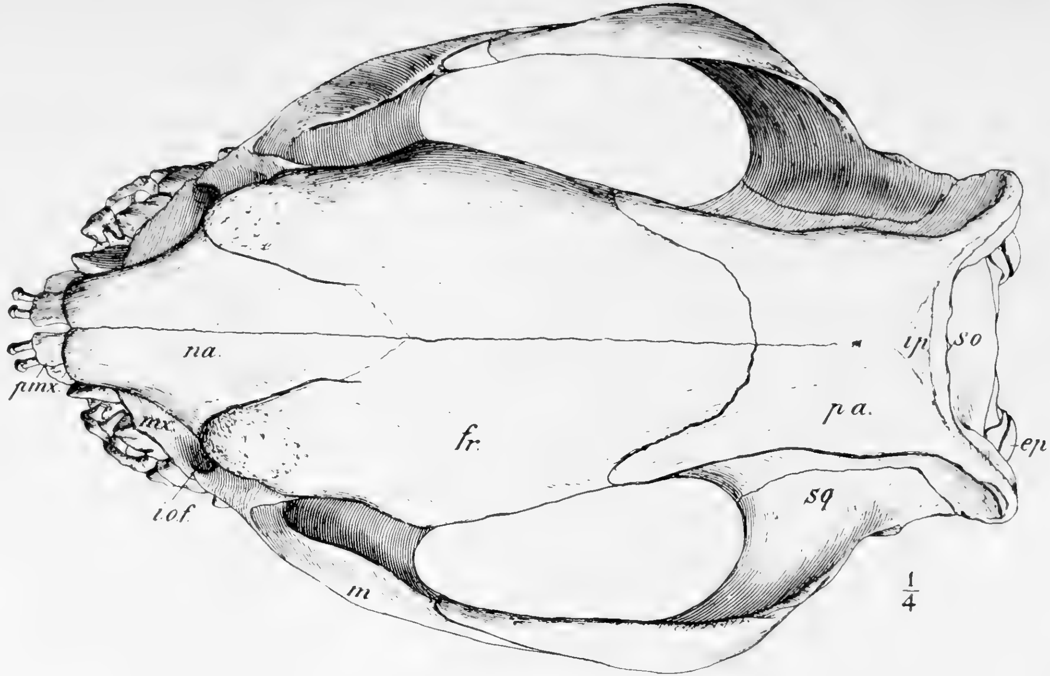
ceramus in sandstones lying above the Marsh quarry and below the bone-bearing horizon at the "Nipple." These remains, only two in number, were not found in situ, and it is impossible to determine at present the horizon to which they belong. From the general appearance of the fragments of sandstone on which they were found I believe they came from the Jurassic, though they may possibly have come from a horizon which by some would be placed in the Dakota, though I must confess my total inability to place any limit to either the top of the Jurassic or base of the Dakota in this region, having experienced the same difficulty encountered by Mr. Darton in the hogback near Buffalo Gap in the Black Hills of South Dakota where he has found dinosaur bones in strata which he thinks may be either Jura or Dakota. I have also examined this latter locality and find the conditions very similar to those in Garden Park and the cañon below. I see no more reason for placing the dinosaur beds near Buffalo Gap in the Lower Cretaceous as has been suggested by Darton than for placing those of the region under discussion in the same formation. The difficulty it seems to me lies in the want of a realization of the fact that different conditions prevailed simultaneously over different though often adjacent regions and caused the simultaneous deposition of different materials. Along the streams and about the shores of the greater bodies of water deposits of sandstone would predominate, while in the quieter waters and especially off shore the finer materials would be thrown down to form the clays and shales of the same series. Wherever we find these shore deposits constituting the Jurassic strata we encounter the same difficulty in separating the Jura from the Dakota, for sedimentation then seems to have been continuous throughout the two periods and we are brought to the question as to the equivalents at such localities of the Lower Cretaceous. Could not the rocks of these two formations in part at least represent the fresh water and land equivalents of the marine deposits belonging to the Lower Cretaceous? Fresh water and marine conditions must have always prevailed, as at present, at the same time over different parts of the earth's surface, though thus far there has been little attempt on the part of geologists and paleontologists to correlate them, each series having as a rule been assigned to a distinct period in the time scale, though it is none the less certain that every marine formation has been accompanied by contemporaneous though more constricted fresh water deposits and that remnants at least of most of such deposits are still

preserved can hardly be doubted, indeed we may be quite positive that every fresh water or æolian deposit of whatever age has its marine equivalent, and the writer sees no reason why the lower members of the dinosaur beds of Garden Park, should not be the equivalents of the marine Baptonodon beds farther north, while the upper dinosaur beds of the same region and the entire series of dinosaur beds farther north would become the equivalents of the marine Lower Cretaceous. That the lowermost dinosaur beds of Garden Park are of an earlier age than those of Como Bluff in southern Wyoming and Piedmont, South Dakota, as well as of the other localities lying to the north, will I think be clearly demonstrated when we come to make a comparative study of the dinosaur remains from each. From the foregoing remarks it will readily appear that in the Garden Park region the problem of separating the Jura from the Cretaceous becomes a difficult one, the top of the Dakota becomes the natural dividing line, whether considered lithologically or paleontologically, and I have no doubt that these difficulties will be further enhanced by the discovery of dinosaur horizons throughout the entire upper series of sandstones and shales which we now consider as belonging to the Dakota. This is almost sure to follow as a reward for a patient and careful search in these beds, and will be most welcome as adding one more link in connecting the long gap which at present exists between Jurassic and Laramie dinosaurs. Of the history of American dinosaurs from the close of the Jura to the beginning of the Laramie we at present know nothing, save *Claosaurus agilis* Marsh from the Niobrara of Kansas and a few remains, for the most part quite fragmentary, described by Leidy, Cope, and Marsh, from the Cretaceous marls of New Jersey and North Carolina.

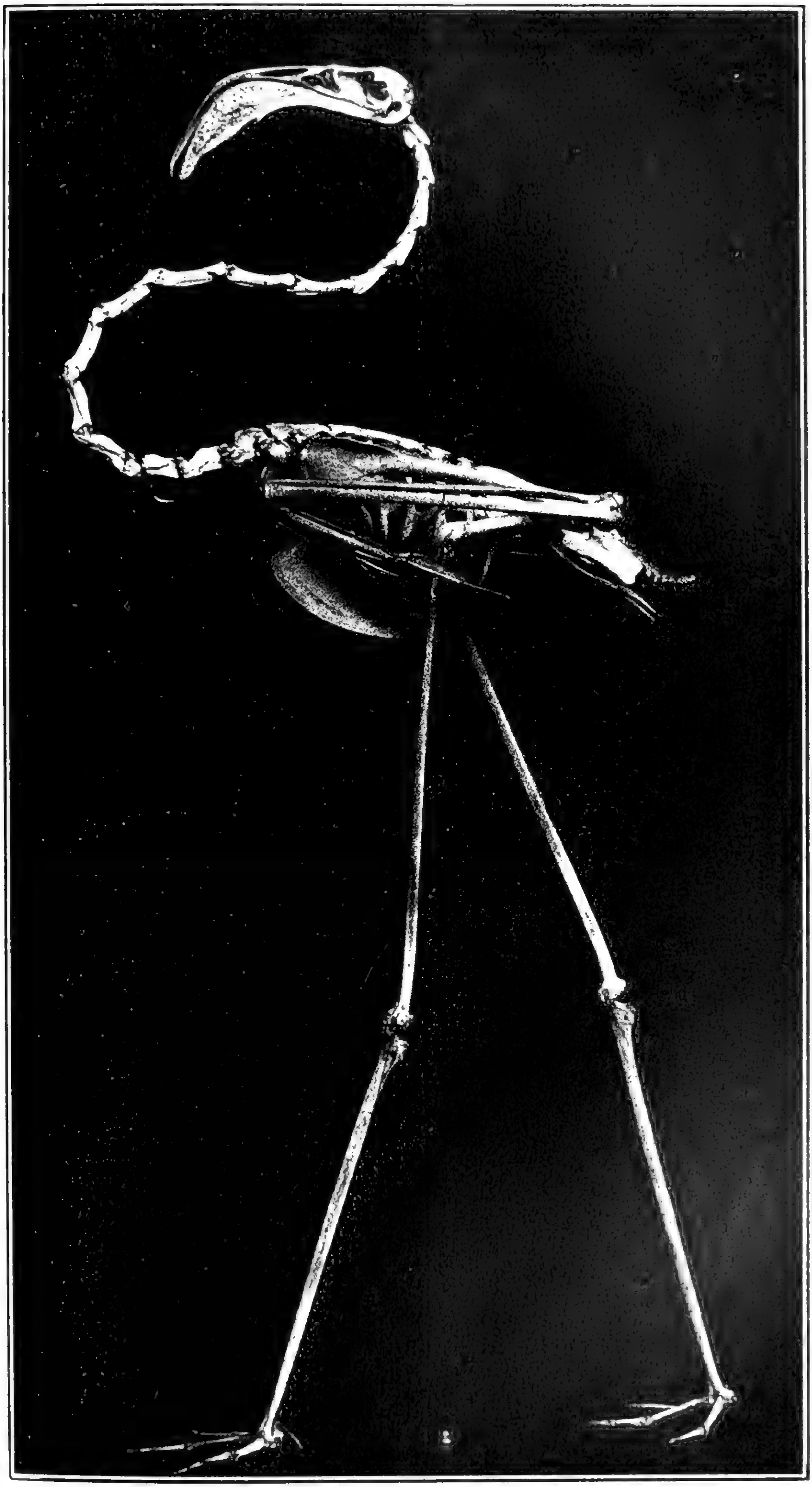
Plate VII.



Titanotherium skull (No. 116).



Titanotherium skull (No. 116).

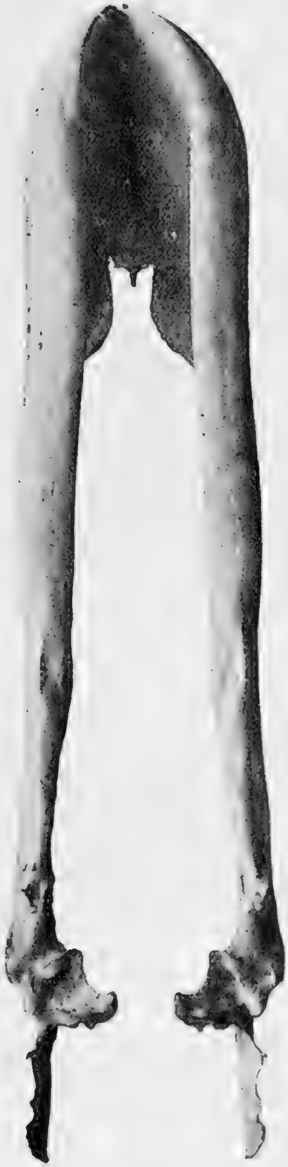


[illegible]

Osteology of the Flamingoes

Fig. 3

Fig. 4



Osteology of the Flamingoes.

Fig. 5

Fig. 6

Osteology of the Flamingoes

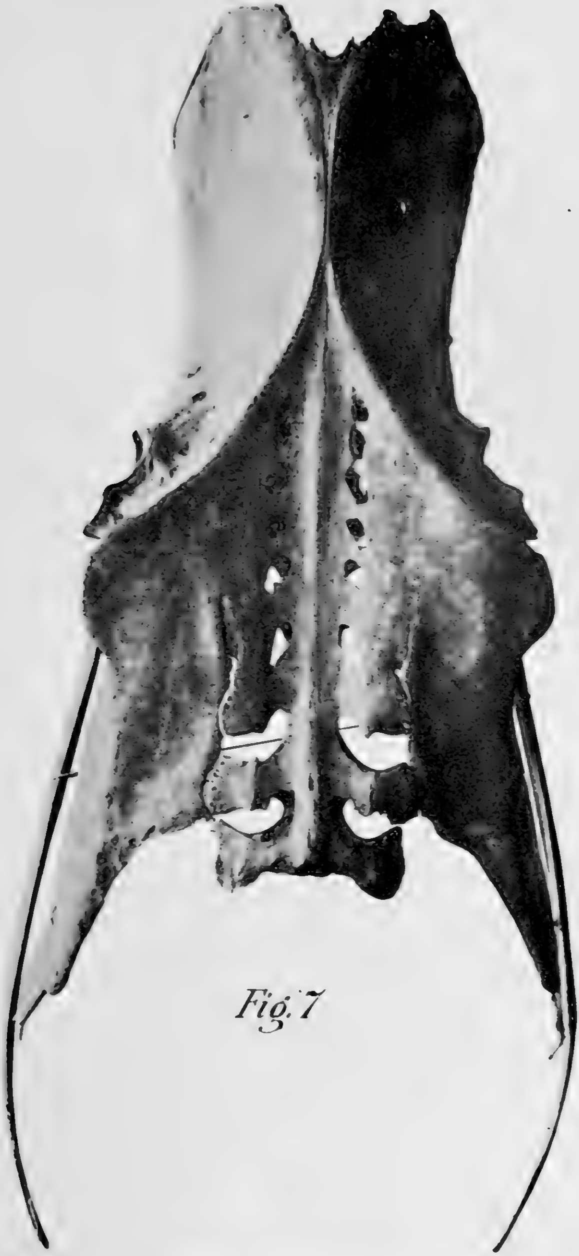


Fig. 7

Osteology of the Flamingoes

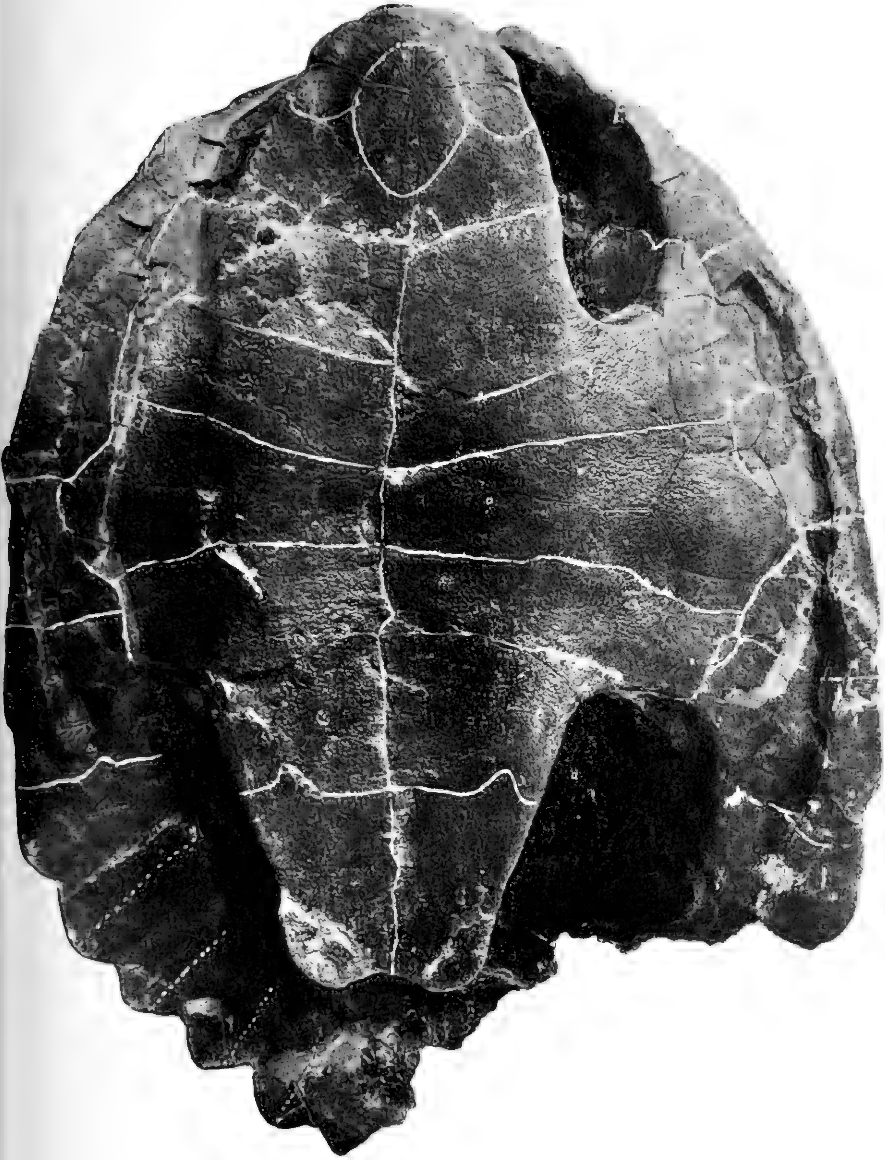
Fig. 8

Fig. 9

Fig. 10

Fig. 11

Osteology of the Flamingoes.



Baëna Hatcheri Hay. About $\frac{2}{5}$ nat. size.

ANNALS

OF THE

CARNEGIE MUSEUM

VOLUME I. NO. 3.

EDITORIAL.

THE work accomplished at the Museum during the months which have elapsed since the appearance of the last number of the ANNALS has been of great interest, and in much of it foundations have been laid for the publication of scientific papers which will undoubtedly add to the sum of knowledge in relation to many matters of interest.

The results of the field work done by the various parties engaged in carrying on explorations in the region of the Rocky Mountains are represented by the accession to the paleontological collections of the Museum of three carloads of crates containing vertebrate fossils. The entire force of the paleontological staff is busily at work in extracting portions of this vast mass of material from the matrix. The revelations that are made as the work proceeds in relation to the osteology of the reptilia and mammalia collected are of the highest interest. Professor Hatcher has well in hand a memoir upon some of the mammalian material, and the present number of the ANNALS contains a valuable paper from his pen upon the structure of the forelimb and forefoot of Brontosaurus, based upon the excellent material obtained by Mr. C. W. Gilmore at Camp Carnegie in Wyoming. Other important papers are in process of preparation.

The Museum has acquired by purchase the entire collection of insects made by Mr. Herbert H. Smith during his several journeys in Brazil and elsewhere in South American countries. Portions of these

collections are already in the hands of specialists for determination and study. Mr. Wm. J. Fox of the Academy of Natural Sciences in Philadelphia has had the fossorial hymenoptera in his possession for some years past, and has published a number of papers upon the same, which have appeared in the Proceedings of the Academy of Natural Sciences of Philadelphia. The types of all the species described by him will be returned to the Carnegie Museum. Mr. Ezra T. Cresson of the Academy of Natural Sciences has studied the *Mutillidæ*, and a paper upon the same will shortly appear in the Transactions of the American Entomological Society. The types of the *Mutillidæ*, of which Mr. Cresson describes numerous new species, will likewise be returned to the Museum. Mr. Wm. H. Ashmead of the U. S. Natural Museum is preparing a paper upon the *Chalcidoidea*, which will be published in the next number of the ANNALS. Mr. Ashmead reports a great deal of very interesting material. The types of the new species, of which he reports a great many, will also be returned to the Museum. Mr. P. R. Uhler of the Peabody Institute in Baltimore has in his hands for purposes of study the *Capsidæ*, upon which it is expected that he will shortly report. Steps are being taken looking toward the distribution to other eminent specialists of various groups contained in these highly important collections. Rev. P. Jerome Schmitt of St. Vincent's College, Beatty, Pa., has kindly undertaken to work up the *Pselaphidæ*. Professor Schmitt is peculiarly well qualified to undertake this rather difficult task.

Considerable time has been consumed in the rearrangement of the entomological collections belonging to the Museum. Attention has been for the past four weeks given principally to the large collections of West African coleoptera, numbering many thousands of species and a vast number of specimens. The design is so soon as possible to distribute these interesting collections among specialists in this country and Europe for final determination. The huge collection of lepidoptera is also being gradually overhauled and rearranged with a view to making it more accessible to students for purposes of study and comparison. No estimate of the exact number of species and specimens in this collection can be accurately made until the work of rearrangement has been completed. In exotic lepidoptera it is undoubtedly the largest and richest collection in the United States. Over three-fifths of all the species listed in Kirby's Synonymic Catalogue of the Butterflies of the World are known to be represented in the collec-

tion, in many cases by a considerable series of specimens. Many genera are represented by every species that is known, and in a very large number of cases either by types or by specimens autographically labelled by the author. When the collection shall have been thoroughly rearranged and placed in order so that it may be carefully studied, it will proye to be for purposes of comparison one of the most important collections in existence anywhere.

In the department of ornithology good work is being done upon the collections obtained in northwestern America, and in the Province of Santa Marta, Columbia, by Mr. Smith.

Mr. F. S. Webster is engaged in mounting the reptilia collected by him in Florida two years ago. He has completed a group of Scotch grouse collected by Mr. Childs Frick in Scotland during the past summer.

The acquisition of the collection of shells belonging to the estate of the late Dr. W. D. Hartman of West Chester, Pa., has added much important material to the already large collection of conchylia belonging to the Museum. A paper upon the species of *Partula* represented in the collection has been prepared by Mr. Herbert H. Smith. This is known to be the best collection of the species of this interesting genus in existence and is very rich in types. It is the standard collection for purposes of reference, and we have had the pleasure since its receipt of having been requested by European conchologists to determine material by its help which it was impossible for them to determine by collections accessible in England and on the continent.

The collections forwarded to the Museum by the Egypt Exploration Fund are of much importance. An account of some portions of these collections from the pen of Mr. W. M. Flinders Petrie appeared in the number of Harper's Magazine issued October, 1901. The Museum owes much to the generosity of the kind friends in Pittsburgh who contributed to the fund in the spring of the year 1901. It is sincerely hoped that those who have contributed will continue to do so, and that from year to year Pittsburgh may receive portions of the valuable finds which are being made in Egypt.

Steps have been taken by the Pennsylvania Chapter of the Sons of the American Revolution to secure legislation in Congress placing certain pieces of ordnance which have been for many years located at the Allegheny arsenal, in the custodianship of the Museum. It is

highly proper that these memorials of the past of Pittsburgh should be preserved here, where they have a deeper meaning than they would have elsewhere, and where they might serve objectively to teach lessons of patriotism to the rising generations in these great cities. The dispersion of historic relics in the hands of individuals who, no matter how highly they may prize them, are not able to display them in such a way that they will benefit the public at large, is greatly to be deprecated.

In the department of ethnology much valuable material has been acquired. A recent accession of interest is a collection of arms and utensils made for the Museum on the Congo by Mr. Walther Karl. The collection has not yet been unpacked and arranged.

Thus gradually the material at the Museum is being enriched by things which cannot fail to prove instructive to the masses and at the same time of positive interest to men of science.

XII. A MOUNTED SKELETON OF TITANOTHERIUM DISPAR Marsh.

By J. B. Hatcher.

The Titanotheres were by reason of their size and great numbers among the more striking and characteristic of the larger mammalia that inhabited the Northern Hemisphere in lower and middle Oligocene times. The family had its origin in the early Eocene, the genus Titanotherium being a direct descendant of Paleosyops from the Wind River and Bridger formations through the genera Manteoceras and Diplacodon of the Uinta.

The family, although of considerable importance throughout the Bridger and Uinta Periods, reached its culmination in the beginning of the White River, and, singularly enough, died out at the close of the period which witnessed the deposition of the sandstones and clays of the Titanotherium beds, found at the base of the White River series.

Their great size, as well as the pair of fronto-nasal horns with which their skulls were provided, afforded these beasts sufficient protection from the comparatively small contemporary predaceous animals. Moreover the character of their dentition was such as would seem to have been admirably adapted for sustaining these animals on a vegetable diet, more especially when the character of the vegetation was of a growth sufficient to permit of its being received into the front or sides of the mouth in considerable quantities, where by the action of the large and powerful molars and premolars it would have been easily detached and masticated. It is scarcely possible to conceive of a more efficient mechanical device for the crushing and grinding of vegetable food than were the molars of Titanotherium. Thus while the Titanotheres were well equipped with a most excellent apparatus for masticating their food they were clearly deficient, through the lack of functional, cupped superior or inferior incisors, in the means requisite for procuring the necessary food supply from a region clothed only with a rather sparse growth of vegetation, consisting for the most part of short grasses, conditions similar to those which prevail to-day throughout our Western plains. It is not at all im-

probable that the subtropical conditions which prevailed over this region in Eocene and early Oligocene times became so altered toward the middle of the latter period that the palms and other subtropical plants known to have lived in those times were replaced by the short, hardy grasses and low straggling bushes so characteristic of semi-arid plains wherever found. Perhaps some such changes as those just suggested brought about the extermination of the Titanotheres. However this may be, it is certain that these animals lived in great abundance over that region now occupied by our Western plains during the deposition of the Titanotherium beds which lie at the base of the White River series, and their remains now appear as the most abundant fossils of these deposits, indicating that their extermination was quite sudden rather than gradual, though the latter method would seem to have been the one most usually followed by nature in the process of the elimination of any particular group of animals from the fauna of a region, the individuals of such group gradually becoming less frequent and finally disappearing altogether. For while remains of these animals are exceedingly abundant throughout the strata pertaining to the Titanotherium series, not a fragment of Titanotherium has ever been found in the Oreodon beds which immediately overlie the former series and have generally been considered as the result of a continuous deposition going on uninterruptedly from the base of the one to the top of the other, though the present writer has maintained that there are important stratigraphical and faunal evidences in favor of a considerable hiatus between these two series. This would obviate the necessity of assuming the sudden disappearance of the Titanotheres and permit of the possibility of their gradual extermination, after the manner which has been so logically and graphically shown by Darwin to have been the case with other groups of extinct animals.

While the remains of these animals are quite common they consist for the most part of isolated skulls and bones, with an occasional limb and foot. Only rarely have even fairly complete skeletons been found, and hitherto there has existed in our museums but one mounted skeleton, that of the American Museum of Natural History in New York.

While collecting vertebrate fossils from the Tertiary deposits of Sioux Co., Nebraska, in August, 1900, the present writer discovered near the base of the Titanotherium beds on Warbonnet Creek, some three miles north of the Brewster and Emmons Ranch, an unusually

complete skeleton of Titanotherium. This skeleton (No. 92 of the Carnegie Museum collection of fossil vertebrates) was carefully exhumed by the present writer assisted by Mr. W. H. Utterback and forwarded to the Museum, where the different bones were freed from the matrix and skilfully articulated, under the direction of the writer, by Mr. A. S. Coggeshall, chief preparator in the department of vertebrate paleontology, aided by his assistants, Messrs. Louis Coggeshall and A. W. Van Kirk. Photographs of the mounted skeleton, taken by Mr. A. S. Coggeshall as it now appears in the exhibition room are reproduced here in plates XVII. and XVIII.

The skeleton was imbedded in the fine clays of the Lower Titanotherium beds, at a horizon perhaps thirty feet above the Pierre shales, which in this locality, as also to the eastward, are usually found immediately underlying the Titanotherium beds. The different portions of the skeleton were for the most part disarticulated, though a few of the vertebræ, metapodials, and one radius and ulna were still in nearly their normal position with reference to one another. No remains of other animals were found associated with it, and the parts recovered lay in such manner as to indicate that the animal lived in the immediate vicinity and met its death at the very spot where the bones were entombed. When found the greater portion of the skeleton was still imbedded in the clays forming the crest of a low rounded bad-land ridge only a few feet in height, the only indications of its presence being a small accumulation of a yellowish mass of finely pulverized bones and teeth where the skull had lain and weathered away so completely as to have left on the surface no piece of a size worthy even of being referred to as a fragment. This pile of bone dust was the first sign of bone detected. On ascending the bad-land ridge ; further indications were to be seen at a distance of some eight feet from this locality but on the same horizon. Here the proximal end of the right femur protruded from the surface, standing almost vertically, while a little to the right of this and on a slightly higher horizon the right iliac portion of the pelvis was exposed in such manner as to show that the pelvis instead of lying in a horizontal position stood almost vertically in the beds with the crest of the left ilium at the bottom and that of the right at the top, while the position and direction of the pubic symphysis was nearly or quite horizontal. These were all the surface indications visible, and it must be confessed they did not offer to the experienced collector of White River vertebrates any very great

promise for the recovery of the nearly complete skeleton that lay buried beneath the surface. However, it was a prospect, and as such must be developed. I first commenced by uncovering the right femur already mentioned as standing vertically in the beds with the proximal end uppermost. On account of its length and the vertical position of this bone it became necessary to remove considerable quantities of the surrounding clay in order to give room to work advantageously. During the progress of this operation the right tibia and fibula and portions of the pes were encountered. Then, as the work was extended in order to take up these, the bones of the opposite hind leg and foot were found while the development of these in like manner led to the discovery of the scapulæ, fore limbs and feet, and a jumbled up mess of vertebræ and ribs, which, though mingled together in the utmost confusion, were in a splendid state of preservation, so that when carefully separated and brought together each was seen to fall very readily into its proper place in the articulated skeleton. By careful work in the field all the bones of the entire skeleton were recovered save the skull, atlas, axis, and third cervical, which had entirely weathered away, as had also the proximal portion of the right ulna and the greater portions of the first and third lumbars, which were only represented by parts of their centra. Of the other bones all were recovered except the manubrium, the second and some three or four of the posterior caudals, and a few of the less important tarsal bones, phalanges and sesamoids. The right ilium and ulna, several of the ribs and a few of the vertebræ were somewhat injured by surface weathering and had to be partially restored in plaster after the same bones from the opposite side, or, as in the case of the vertebræ, from the opposite sides of the same bone. The missing cervicals were replaced in the mounted skeleton by actual bones from a second individual of approximately the same size and proportions, while the skull is taken from a third and decidedly smaller skeleton, as is shown by a comparison of the associated bones common to each, and as will readily appear from an examination of the accompanying plates. This skull is only placed temporarily with the present skeleton and will be replaced by another of more appropriate size and proportions when such shall have been procured.

The missing sternal, caudals and foot bones mentioned above were modeled in plaster from others in our collections. These are indicated in the articulated skeleton by a red cross, while such portions

of the bones as are restored in plaster are outlined with a red line, while the skull and substituted cervicals are distinguished by their department numbers from the bones actually belonging with the skeleton. There is thus preserved a definite record of all the associated material.

An examination of the mounted skeleton shows that the animal, while of moderately robust proportions, as indicated more especially by the fore limbs and anterior dorsals, belonged to the group of short-footed, brachycephalic Titanotheres, with rather long but pointed nasals and short rounded horn cores almost circular in cross-section, very abundant in the lower and middle Titanotherium beds, and the direct ancestors of *T. robustum* Marsh, from the upper beds.

Beside the present skeleton there are in the museums of this country three other nearly complete skeletons of Titanotheres. The articulated skeleton already mentioned as belonging to the American Museum of Natural History in New York, discovered by Dr. J. L. Wortman and Mr. O. A. Peterson in 1892, in the upper Titanotherium beds of the South Dakota Bad Lands. The excellent, though poorly collected skeleton in the Yale Museum, which was discovered and unearthed by Mr. H. C. Clifford in 1875 in the Upper Titanotherium beds near Chadron, Nebraska, and later made the type of *T. robustum* by Marsh, and a third skeleton discovered by Mr. H. F. Wells at the summit of the Titanotherium beds in the South Dakota Bad Lands in 1894. This last was carefully taken up by the present writer and is now stored in the Museum of Princeton University. The skull and lower jaws alone of this skeleton have been freed from the matrix and prepared for study, so that its skeletal features cannot be used for purposes of study and comparison, though the skeleton itself is in many respects remarkably complete.

As will be noticed from the above remarks, the three skeletons just referred to are all from the same horizon, Upper Titanotherium Beds, and a comparison of the cranial and dental characters of each shows that they most likely all pertained to the same species, *T. robustum* Marsh. The Carnegie Museum skeleton therefore derives additional importance from its pertaining to another species, *T. dispar* Marsh, and having been found in a different horizon (lower Titanotherium beds) from the others. As might be expected in skeletons derived from deposits separated by so great a thickness as are the upper and lower Titanotherium beds, that from the latter exhibits several anatomical differences distinct from those derived from the former series.

Not only is the skeleton of *T. dispar* smaller and somewhat less robust than that of *T. robustum*, but there are still other differences which appear even upon the most superficial examination. Compare the broad heavy neural spine of the first dorsal of the American Museum skeleton of *T. robustum* with the slender, pointed spine of the same vertebra in our skeleton of *T. dispar*, which latter more closely resembles that of the last cervical in the former than its homologue, though really somewhat intermediate between the two.

In the carpus of *T. dispar* the trapezium is present, though apparently absent in *T. robustum* and the other associated species from the upper beds. The presence of this element in the carpus of the titanotheres was first pointed out by Hatcher, who had detected it in some feet found near the base of the beds in the Hat Creek basin in Nebraska, while collecting for the late Professor Marsh in 1886. These feet were not found associated with skulls, and at the time of publishing my original notice (*See the Titanotherium Beds*, by J. B. Hatcher, Am. Nat., March, 1893) I correlated the presence of a trapezium with those skulls described by Professor Marsh as possessing three lower incisors and distinguished as *Teleodus avus* Marsh. Since then, however, I have discovered a number of other complete front feet and examined many isolated trapezoids of the Titanotheres from the lowermost horizon, and find that the trapezium is in every instance present, as indicated either by the bone itself or its articular facet on the surface of the trapezoid. It cannot therefore be considered as belonging exclusively to those forms with three lower incisors, as I had doubtfully suggested in my first paper. It is present on both the front feet of our skeleton of *T. dispar*.

Compared with the fore limbs the hind limbs are long and slender, as is the case in all the Titanotheres, though the great expanse of the ilia indicate rather robust proportions for the posterior region.

The vertebral formula in our skeleton is C.7, D.17, L.3, S.4, C.18. The third caudal carries a large chevron, as does also the same vertebra in Professor Marsh's type of *T. robustum*. In the mounted skeleton of the American Museum collections the tail of which is composed of isolated vertebræ from different individuals, this vertebra has been erroneously assigned the second position in the caudal series. While as stated above the second caudal was not recovered in our skeleton, nevertheless it is apparent that there is a vertebra missing between the first caudal and that bearing a chevron, and moreover

in the type skeleton of *T. robustum* this region of the tail is complete and shows conclusively that it is the third and not the second which bears the large chevron.

The different degrees of distortion, due to the various positions of the several bones as they lay imbedded in the matrix, were both interesting and instructive, showing in some cases to what very great pressure they had been subjected and in others how the general form and proportions of a bone may be altered by slow and extreme pressure without leaving upon its external surface more than faint indications of such changes. As an example of the first instance I may cite the femora shown in Figs. 1, 2, 3, 4, plate XVI., which represent the right and left femora of our skeleton. As stated above the former of these stood upright in the beds and received the force exerted by the pressure of the superincumbent strata in a direction parallel with its longer axis, while the left femur lay in a horizontal position and the same pressure was directed at right angles to its longer axis, directly opposite conditions to those affecting the right femur, so that the tendency was to shorten the right femur with little or no change in its cross-section, while the left femur was slightly lengthened and considerably flattened. The difference in length thus produced in these two femora from opposite sides of the same individual are well shown in the photographs reproduced in plate XVI. Figs. 1 and 2 show respectively the right and left femora as they appeared when unpacked in the museum laboratory, still covered with strips of gunnysacking saturated with flour paste and applied in such manner as to hold each fragment in its proper position. Figs. 3 and 4 show the same bone with the covering removed, the left with the different pieces carefully cleaned and cemented together, while those forming the right are fitted together but not cemented. As will be seen by these photographs the right femur was some six inches shorter than the left, and this difference in length may be taken as a very fair estimate of the vertical compression of the clays containing them due to the expulsion of the aqueous material and the rearrangement of the particles composing the clays brought about by the enormous pressure exerted by the superincumbent strata accumulated long subsequent to the deposition of the beds containing the bones, and which at this locality must have had a vertical thickness of more than 1,000 feet.

The humeri occupied relatively the same positions as the femora except that in this case it was the left that stood upright while the

right was lying horizontal, and there was in these two bones the corresponding difference in length shown by the femora. In each of these instances the bones bore abundant evidence of the great distortion they had suffered through pressure, though it is doubtful if anyone would have believed it possible that the right femur or left humerus had suffered so great a reduction in length had not the corresponding bones of the opposite sides been present for comparison and in a condition comparatively free from distortion. Other portions of the skeleton, more especially the radii and calcanea, lay in such positions that in one instance there would appear a decrease in the transverse diameter attended by a corresponding increase in the fore and aft diameter of the shaft or tuberosity or vice versa, according as these bones lay on their lateral or antero-posterior surfaces when imbedded. In such instances, while the surfaces of these bones bore no faults or fractures or other evidences of distortion, yet they exhibited marked differences, especially as regards proportionate breadth and depth at almost any particular point. The first examples (femora and humeri) show to what extremes the process of rearrangement of the particles in any given deposit may be carried after sedimentation has ceased, while the last demonstrates the great care that should be exercised in employing proportionate measurements for the diagnosis of genera and species in vertebrate paleontology.

The skeleton has been mounted standing on a base of artificial matrix calculated to represent the color and texture of the clays of the Titanotherium beds. It is supported by two uprights made of one and one-fourth inch gas pipe. These uprights are firmly fastened to the base and are placed one each between the fore and hind limbs. Above they connect with the iron rods which give support to the pelvis and vertebral column. Each limb and foot is supported by a separate rod nicely fitted to the posterior and inner surface of the bones and covered over with an artificial matrix. The head, instead of being supported by an additional third upright, as commonly done in such cases, is carried by a curved piece of inch piping attached to the forward upright near the top of the latter and held in place by a bit of half-inch pipe running parallel with the cervical series and connected with the anterior of the two uprights above referred to. This innovation, introduced by Mr. Coggeshall, is a decided improvement upon the old method of mounting such skeletons. The many difficult mechanical problems have been met and overcome entirely by the skill of Mr. Coggeshall.

While no attempt has been made to restore the missing parts in such manner as to conceal their real nature, a definite color scheme has been carried throughout, including not only such parts of the skeleton as were either wholly or partially restored in plaster, but the supporting rods and base of artificial matrix as well, were so colored as to harmonize with the natural color of the bones. The present writer must alone be held responsible for whatever anatomical inaccuracies there may be detected in the reconstruction of the skeleton.

EXPLANATION OF PLATES.

PLATE XVI.

Fig. 1. Front view of the right femur of *Titanotherium dispar* Marsh (No. 92) as taken up in the field.

Fig. 2. Same view of left femur from same skeleton.

Fig. 3. Front view of femur shown in Fig. 1 with bandages removed.

Fig 4. Front view of femur shown in Fig. 2 with bandages removed and the different parts cemented together. All figures $\frac{2}{13}$ natural size.

PLATE XVII.

Oblique front view of mounted skeleton of *Titanotherium dispar* Marsh (No. 92), $\frac{1}{22}$ natural size.

PLATE XVIII.

Side view of mounted skeleton of *Titanotherium dispar* Marsh (No. 92) $\frac{1}{20}$ natural size.

CARNEGIE MUSEUM, DECEMBER 12, 1901.

XIII. STRUCTURE OF THE FORE LIMB AND MANUS OF BRONTOSAURUS.

By J. B. Hatcher.

Notwithstanding the abundance of the remains of the Sauropod Dinosaurs in the Jurassic deposits of the West and the exceptional vigor with which the collecting of these remains has been carried on, in the earlier days by the late Professors Marsh and Cope and more recently by Osborn, Williston, and the Carnegie and Field Columbian Museums, much still remains to be learned concerning the complete osteology of even the commoner genera and species. By the combined efforts of all engaged in the collecting and studying of Dinosaur remains, rapid and substantial progress is being made in our knowledge of the structure of these gigantic reptiles which in size equalled or surpassed that of any other known animals either living or extinct. The facts set forth in the present paper concerning the structure of the manus of Brontosaurus, which most likely does not differ materially from that of the same element in the other genera of the Sauropoda, affords a striking illustration of the proximity with which one discovery follows another, shedding new light on doubtful points and making it for the first time possible to substitute facts for conjecture concerning the structure of previously unknown characters. Hardly had the Memoir on Diplodocus,[1] prepared by the present author and based upon much the best material pertaining to that genus yet discovered, been received from the press, than a second skeleton, belonging to a distinct but closely allied genus, *Brontosaurus*, was received at the Museum. This contained, beside many other parts of the skeleton, a nearly complete fore limb and foot, elements entirely wanting in our skeleton of Diplodocus. This fortunate discovery calls for an entire revision of the structure of the manus of Brontosaurus at least, as that element has been reconstructed, figured and described in recent publications by Prof. H. F. Osborn,[2] while at the same time making it extremely probable that the manus of both Morosaurus

[1] Memoirs of the Carnegie Museum, Vol. I., No. 1.

[2] Bull. Am. Mus. Nat. Hist., Vol. XII., pp. 161–172, and Vol. XIV., pp. 199–208.

and Diplodocus has been erroneously constructed both in Osborn's figures and in my own restoration of the skeleton of the latter genus, where, as stated in the text, I followed that author when reconstructing the anterior limbs and feet, parts of the skeleton not represented in our collections.

DISCOVERY OF THE SKELETON OF BRONTOSAURUS (No. 563).

The skeleton with which the limb and foot under discussion belonged was discovered by Mr. Charles W. Gilmore, a graduate of the University of Wyoming and member of the staff of the Section of Vertebrate Paleontology of this Museum. It was found in the shales of the Atlantosaurus beds, about one mile south of Sheep Creek in Albany County, Wyoming. The particular locality (Quarry E) at which the skeleton was dug up was distant about one quarter mile from Quarry D, which had yielded the two skeletons of *Diplodocus carnegii* (Nos. 84 and 94) belonging to this Museum's collections. While both quarries are in the same bed of shale, Quarry E is in a distinctly lower horizon than Quarry D. Careful measurements taking into consideration the dip of the strata would probably place the horizon of Quarry D from 30 to 40 feet above that of Quarry E.

The different parts of the skeleton recovered were for the most part disarticulated when found. But when, as with the present limb and foot, any bones were found in nearly or quite their normal positions, such portions were taken up and packed by Mr. Gilmore with such precaution and skill that they have been received in the laboratory oi the Museum in the same positions in which they were found and still partially imbedded in the original matrix. Moreover, in order that no possible aid should be lost which a knowledge of the various positions of the different bones when found in the quarry might furnish in assigning each to its proper position in the skeleton after their arrival in the Museum, Mr. Gilmore prepared an excellent diagram of the quarry and carefully located on this each bone as it was uncovered during the process of excavation, thus securing a permanent and reliable record of the relative positions of the different parts of the skeleton as they lay imbedded in the rock.

RELATIVE POSITIONS OF THE HUMERUS, RADIUS, ULNA AND MANUS IN THE MATRIX.

When found the forearm and manus lay with the palmar side up. The humerus was not in position at the proximal end of the radius

and ulna, but lay with its dorsal side up, the middle of the shaft resting on the proximal end of the ulna with its longer axis at right angles to that of the radius and ulna.[1] The proximal end of the radius lay in the radial groove on the anterior surface of the ulna. Lying between and upon the palmar side, near the distal ends of the radius and ulna, was a large flat bone, the scapho-lunar, presenting on one side a gently but regularly convex surface and on the other two flat, subequal surfaces separated by a low ridge.

Metacarpals I., II., III., IV., and V. were in regular order at the distal extremity of the radius and ulna. The proximal ends of metacarpals I. and V. were closely applied to the external lateral surfaces of the distal ends of the radius and ulna, indicating that in life they articulated directly with these bones perhaps through the intermedium of heavy cartilaginous pads, while the three median metacarpals were still interlocked at their proximal ends, as shown in plate XX., and a little more removed from the distal ends of the radius and ulna, as though to accommodate the supposed scapho-lunar mentioned above.

The proximal phalanges of all the digits were present and nearly in their normal position with relation to their respective metacarpals. That of digit I. was in contact with its metacarpal but shifted from its normal position so that its external lateral surface was opposed to the distal end of the metacarpal, with its proximal articular surface turned inward toward the median axis of the foot and the distal outward. The proximal phalanx of digit II. was in position at the extremity of metacarpal II., but very much flexed, so that its longitudinal axis stood almost at right angles to that of metacarpal II. The first phalanx of digit III. was found in its proper position at the extremity of metacarpal III. and there was on the palmar side, interposed between it and that bone, a small rounded sesamoid. The proximal phalanx of the fourth digit was in position articulated with metacarpal IV. That of digit V. lay at the extremity of its metacarpal, but with its external lateral surface opposed to the distal end of the latter. These were the only phalanges found with this foot except the ungual of the first digit, which lay in its normal position with reference to that of the first phalanx as the position of the latter has been described above, except that it was turned on its side and had been moved

[1] In a preliminary note in *Science* I stated that the humerus was in position at the proximal end of the radius and ulna, having misunderstood Mr. Gilmore in reference to this particular. See *Science*, Vol. XIV., No. 365, p. 1015.

slightly backward and lay with its articular surface abutted against the external border of the distal articular surface of the first phalanx and the external lateral surface of metacarpal I.

There was a slight vertical displacement in the carpal region so that the distal ends of the radius and ulna were a little lower than the metacarpals. Metacarpals I. and V. lay in such position with reference to II., III. and IV. as to indicate that the proximal ends of these bones were arranged in the arc of a circle and not horizontally.

PREPARATION OF THE FORE LIMB AND MANUS IN THE LABORATORY.

The same painstaking care given by Mr. Gilmore to the work in the field has been exercised in the laboratory in the preparation of the limb, manus, and other portions of the skeleton for study and exhibition purposes.

The entire limb and foot were taken up in two blocks. One of these contained the humerus while in the other were imbedded the radius, ulna and manus. These were packed in separate boxes and forwarded to the Museum along with the remaining portions of the skeleton and other material collected during the season by Mr. Gilmore's party, amounting in all to some fifty large cases.

When unpacked in the laboratory the block containing the radius, ulna, and manus, as also that containing the humerus, were in a perfect state of preservation, having sustained no injury while being transported from the Wyoming quarry to the Museum in Pittsburg. These blocks were each placed on an operating table resting on the side which had been lowermost as they lay in the quarry. That containing the forearm and manus was assigned to Mr. Gilmore for preparation, while Mr. Louis Coggeshall prepared the humerus. The strips of burlap, which had been saturated with paste, or cement and plaster, and wound about the blocks in such manner as to form a perfect casing, binding together the entire mass and holding even the most minute fragment in its original position, were carefully cut away from the superior surface, exposing the entire palmar surfaces of the radius, ulna, and bones of the manus. The upper surface of these bones was then thoroughly cleaned and the matrix removed from between and about them, without disturbing in any way their original positions, until each stood out in high relief. Next the photograph reproduced in plate XIX. was taken and a plaster bed then made over all in order to preserve an impression of the bones as they lay still

slightly fixed in the original matrix. After this bed had hardened sufficiently it was removed and the different bones were taken up and thoroughly cleaned and fitted in their proper positions as indicated by the respective depressions made by each on the surface of the plaster bed. When all had been thus cleaned and replaced the photograph reproduced in plate XX. was taken, showing the relative position of the different elements from the dorsal or lower side of the forearm and manus as they lay imbedded in the shale. In this manner we have preserved the complete record of this limb and foot from the time of its discovery until its final preparation in the laboratory. No single fact has been lost which would aid us in a correct interpretation of the structure and arrangement of the different elements in the fore-limb and manus of this particular type of dinosaur. To some the careful methods thus detailed may appear as superfluous, but I am convinced that they are not only desirable, but absolutely necessary, if we are ever to arrive at an exact and satisfactory understanding of the skeletal structures in the Dinosauria, where articular surfaces are in most cases so poorly defined as to afford little evidence concerning the exact position of bones found isolated, or detached and misplaced through careless or indifferent field and laboratory methods. It is impossible to attach too much importance or give too great credit to Mr. Gilmore for the appreciation, judgment, and skill shown in collecting and packing this skeleton, while the ingenuity of Mr. A. S. Coggeshall in devising and improving laboratory methods, whereby these heavy and exceedingly fragile bones are readily cleaned and hardened so as to permit of being safely handled, is deserving of the greatest praise.

DESCRIPTION OF THE LIMB.

The Humerus.—The shaft of this bone is much constricted, while the extremities are greatly expanded transversely, the proximal to a much greater extent than the distal. There is a very prominent deltoid ridge extending along the anterior external border from the proximal end throughout one-half the length of the bone. Between the ridge and the inner margin there is on the anterior surface a rather deep basin, subtriangular in outline, bounded above by the anterior border of the slightly thickened broad proximal end, and externally and internally by the deltoid ridge and internal lateral margins, which converge inferiorly where the shaft becomes much restricted. The proximal end has the transverse diameter much expanded while the

fore and aft is quite short. In the present specimen the differences between these two diameters is somewhat magnified through distortion due to crushing. Superiorly the proximal end is regularly convex, so

FIG. 1. Anterior view of right humerus, about one tenth natural size. (No. 563.)

that when seen from behind or in front its upper border describes an almost perfect arc, the chord of which in the present specimen has a length of 600 mm. (23⅝ inches). The head is placed about midway between the external and internal borders, but a little nearer to the latter, and is directed rather strongly backward much as in the testudinata. It is very rugose, only moderately expanded in either direction.

Distally the transverse diameter of the humerus is about double the fore and aft. The articular surface is exceedingly rugose and deeply pitted as though covered in life with heavy cartilaginous epiphyses

FIG. 2. Posterior view of right humerus, about one-tenth natural size. (No. 563.)

which never became thoroughly ossified and through the intermedium of which it articulated with the radius and ulna. On the posterior border there is an emargination indicative of an anconeal fossa. This is extended into the articular area in such manner as to cause a slight median constriction on the posterior side directly opposite a slight anterior expansion on the anterior surface. There is a small and

imperfectly defined external condyle. The posterior border of the humerus is regularly convex transversely throughout most of its length, though much flattened proximally and slightly grooved distally. The principal characters are shown in Figs. 1, 2, 3, which present respectively the anterior, posterior, and distal views of this bone. The principal measurements are:

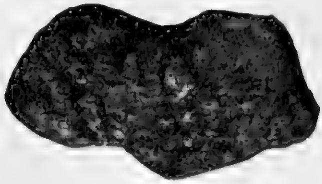


FIG. 3. Distal end of right humerus about one-tenth natural size. (No. 563.)

Greatest length,	1,100 mm.	43¼ in.
" transverse diameter at proximal end,	600 "	23⅝ "
" " " " distal "	410 "	16⅛ "
Transverse diameter at point of greatest constriction,	210 "	8¼ "

The Radius and Ulna.—These bones are subequal in size. The distal third of the ulna is a little more slender than the same portion of the radius as shown in plates XIX. and XX., and in Figs. 4, 5, 6, 7, 8, and 9. The shaft of the radius is constricted medially while the ends are about equally expanded. The proximal end is semi-circular in cross-section, the convex surface fitting nicely into the radial groove on the anterior surface of the proximal end of the ulna. Proximally the radius articulates only with the anterior and internal portion of the distal articular surface of the humerus, as is well shown in Figs. 4 and 6 and in plate XX. The proximal end of the ulna entirely encloses that of the radius posteriorly and externally so that its articular surface is opposed to that of the distal end of the humerus posteriorly throughout its entire breadth, while at the same time presenting a broad and deep articular surface on the anterior projection which encloses the radius externally for contact with that of the anterior and external surface of the humerus. The contact of the radius with the humerus is thus limited to the antero-internal surface of the humerus instead of the antero-external as determined by Osborn and Granger,[1] so that these bones are not so completely crossed as these authors had supposed, but occupy positions almost identical with those figured by the late Professor Marsh as obtaining in the fore limb of Morosaurus.[2] Seen from above the proximal end of the ulna may best be described

[1] See Bul. Am. Mus. Nat. Hist., Vol. XIV., pp. 199–208.

[2] See Part I. Sixteenth An. Report U. S. G. S., pp. 143–244, Plate XXXVII.

as tri-radiate. The rays are formed by the posterior anconeal spine, the directly opposite external anterior projection and the widely ex-

FIG. 4. Front view of right radius, ulna and manus in position about one-tenth natural size. (No. 563.)

panded internal portion. The first two of these are subequal and much smaller than the last. All are separated by concave surfaces. There is a deep cavity on the posterior surface between the anconeal spine and the internal, lateral margin of the ulna. Distally the radius shows a prominent rugosity on the posterior side near the externa border. This commences about four inches from the distal extremity and continues as a prominent narrow ridge for a distance of nine inches. At about one third the distance from the lower to the upper

end of this rugosity it is interrupted by a deep groove which starts on the inner side, runs obliquely downward and outward, completely

FIG. 5. Distal ends of right radius and ulna in position, about one-tenth natural size. (No. 563.)

FIG. 6. Proximal end of right radius and ulna in position, about one-tenth natural size. (No. 563).

bisecting the rugosity. This groove doubtless served for the transmission of an artery. Opposed to this rugosity on the radius there is a similar one on the middle of the internal surface of the ulna near its distal extremity. These rugosities doubtless served for the attachment of the muscles which held these bones in place. Seen from below, the articular surface of the distal end of the radius has the form of an elongated ellipse with an area somewhat exceeding that of the distal end of the ulna, which takes the form of an oblique quadrangle with its two axes nearly equal. There is on the internal surface of the distal end of the ulna a rather deep emargination or fossa for the reception of the rounded postero-external angle of the distal end of the radius. This emargination appears, though less distinctly, on the internal border of the distal articular surface of the ulna, as shown in Fig. 5. Its presence affords great assistance in the proper adjustment of these bones, since when they are so placed that the convex surface of the proximal end of the radius fits nicely into the radial groove of the ulna and the postero-external angle of the distal end of the radius in this fossa there can be no question as to the correct relative positions of these bones. The articular surfaces of the distal ends

FIG. 7. Posterior view of right radius, about one-tenth natural size. (No. 563.)

of the radius and ulna display different degrees of rugosity. The postero internal portions of each are extremely rugose and deeply

FIG. 8. Posterior view of right ulna, about one-tenth natural size. (No. 563.)

FIG. 9. Anterior view of right ulna, about one-tenth natural size. (No. 563.)

pitted, while toward the center the surface becomes less indented and the external one half of each presents a polished surface marked with shallow corrugations.

PRINCIPAL DIMENSIONS OF RADIUS AND ULNA.

Greatest length of radius,	755 mm.	$29\frac{5}{8}$ in.
Transverse diameter of radius at distal end,	230 “	$9\frac{1}{8}$ “
Fore and aft “ “ “ “ “ “	105 “	$4\frac{1}{16}$ “
Transeverse “ “ “ “ proximal “	240 “	$9\frac{3}{8}$ “
Fore and aft “ “ “ “ “ “	95 “	$3\frac{5}{8}$ “
Transverse “ “ “ “ middle of shaft,	127 “	5 “
Greatest length of ulna,	740 “	$29\frac{1}{8}$ “
Transverse diameter of ulna at distal end,	155 “	6 “
“ “ “ “ “ proximal “	330 “	13 “
Fore and aft diameter at summit of anconeal spine,	205 “	$8\frac{1}{8}$ “

The Carpus.—There was but one carpal bone found with the present limb and foot, that marked X, in plate XIX. This agrees very closely

with the description given by Osborn and Granger of the supposed scapho-lunar in Diplodocus, and with those authors I agree in making it homologous with that element in the mammalian carpus. If my interpretation of the position of this bone in the manus is correct the following description of this element would apply. The general form is that of a circular disc, thin in front but considerably thickened posteriorly. The superior surface is crossed antero-posteriorly by a low, broad ridge which divides it into two slightly concave and subequal surfaces, the larger and smoother of which was for articulation with the external half of the distal end of the radius, while the smaller and more rugose surface articulated with the internal portion of the distal articular surface of the ulna. Inferiorly this bone presents a gentle convex, polished, but corrugated surface for articulation with metacarpals II., III. and IV. No other carpals were found with or near this foot, and after a careful study of it and the articular surfaces of the distal ends of the radius and ulna and considering the position in which metacarpals II., III. and IV. lay with reference to these bones and metacarpals I., and V., as shown in plates XIX. and XX., it appears quite probable that it was the only ossified element present in the carpus of Brontosaurus and therefore that the Brontosaur carpus, like the tarsus, consisted of a single element. An oblique front view of this bone is shown in Fig. 10.

FIG. 10. Right scapholunar front view seen obliquely from above, about one-fourth natural size. (No. 563.)

PRINCIPAL DIMENSIONS.

Greatest transverse diameter	203 mm.	7⅞ in.
" fore and aft "	155 "	6⅛ "
" thickness	55 "	2⅛ "

The Metacarpals.—All the elements of the metacarpus were present and in approximately their normal positions when the foot was uncovered, as shown in plates XIX. and XX.

Metacarpal I. is short and much the strongest bone of the entire series. The proximal end is very deep, but much compressed. The articular surface is gently concave vertically and convex transversely. The internal lateral margin of the proximal end is regularly convex so that this margin and the proximal articular surface as well conform

to the internal margin and internal articular surface of the radius with which during the life of the animal it probably had a direct, cartilaginous articulation. The external lateral margin of the proximal end is regularly concave and just in front of the articular surface there is a deep cavity for the reception of a corresponding prominence on

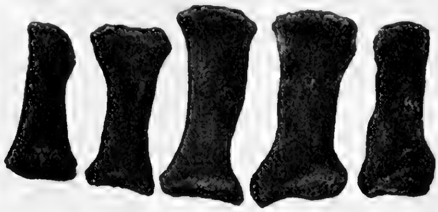


FIG. 11. Dorsal view of metacarpals of right manus placed side by side in regular order, about one-tenth natural size. (No. 563.)

the internal margin of metacarpal II. The external surface is rugose throughout the entire length of the bone; it is much constricted vertically in the middle, but with decided distal and proximal expansion for contact with metacarpal II. The internal lateral surface is regularly but gently convex vertically throughout the entire length of the bone and only slightly constricted vertically in the middle region. The superior surface gradually broadens from the proximal to the distal end. The inferior surface is deeply concave longitudinally, broad at the distal extremity, but reduced to a sharp narrow ridge at the proximal end. The distal articular surface has the vertical and transverse diameters subequal. It is continued well back on the palmar side of the bone in order to accommodate the thin sheet of bone which projects posteriorly from the palmar side of its proximal phalanx. There is a vertical, median groove for the accommodation of the low median keel of the latter.

Metacarpal II. is longer and more slender than the preceding, although decidedly stronger than metacarpal III. It is somewhat constricted medially both in its vertical and lateral diameters. Compared with metacarpal I. it is broad, but greatly depressed. The superior as well as the distal portions of the lateral surfaces are smooth, while the inferior and proximal portions of the lateral surfaces are covered with rugosities. The inferior internal angle of the proximal end of this bone is especially modified so as to fit nicely into the deep cavity just described as present on the external lateral surface of metacarpal

I. These bones are so interlocked that when placed in position a considerable portion of the proximal end of mc. II. is covered over by the superior border of the cavity in mc. I., while the proximal

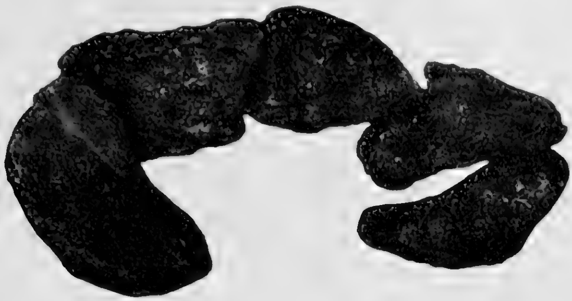


FIG. 12. View of proximal extremities of metacarpals of right manus in position about one-fourth natural size. (No. 563.)

end of the latter is raised above that of mc. II. so as to articulate directly with the radius. There is a broad, shallow excavation on the external lateral surface at the proximal end of mc. II. for the reception of the internal proximal angle of mc. III. The proximal articular surface of mc. II. is broad above and somewhat narrowed inferiorly. Its superior and inferior margins are bounded by nearly straight, horizontal lines. The surface is very slightly and regularly convex in all directions. The distal articular surface is broad and deep, though in the present specimen the latter diameter has been somewhat diminished by pressure. Just anterior to the rugosity on the internal lateral surface of the proximal end of this bone there is a deep groove leading obliquely downward and forward to the palmar surface. This may have served for the transmission of a flexor tendon.

Metacarpal III. is of equal length, but decidedly more slender than mc. II. The superior surface is smooth and regularly convex. There is a noticeable lateral constriction at about the middle of the distal one-half of the bone. On the internal lateral surface of the proximal end there is a flat rugose area, broad proximally, but narrowed distally, which disappears toward the middle of the shaft. The internal, proximal, lateral angle is so shaped as to fit nicely into the cavity on the external lateral surface of the proximal end of mc. II., causing an interlocking of the proximal ends of these bones. The proximal articular surface is subtriangular in outline through the external superior

lateral angle of the proximal end being produced into a strong triangular process which overlies a corresponding projection on the internal inferior lateral angle of mc. IV. The external outer margin of this process on mc. III. presents a rounded articular surface which fits into a deep groove on the superior internal surface of mc. IV., thus causing these bones to interlock at their proximal ends, though somewhat less perfectly than mcs. I. and II., and II. and III. The palmar surface of mc. III. is rugose and there is a broad median ridge continued throughout the entire length of the bone. The distal end is broad and deep, convex, and with an indistinct groove inferiorly.

Metacarpal IV. is shorter and more slender than mc. III. It is greatly constricted medially and at the point of greatest constriction it is nearly circular in cross-section instead of flat as in mcs. II. and III. On the internal lateral surface of the proximal end there is the deep groove mentioned above for the accommodation of a corresponding prominence on the external lateral surface of mc. III. The proximal articular surface is triangular. The lines bounding the internal and superior borders are of equal length and meet at right angles so as to form the base and perpendicular of a right-angled triangle, while the hypotenuse is formed by the line bounding the external lateral border. The latter, when this bone is placed in its natural position, runs obliquely downward and inward toward the median axis of the foot. There is a broad, shallow emargination on the external lateral surface near the proximal end. The distal end presents a broad and deep articular surface concave transversely and convex supero-inferiorly.

Metacarpal V. is shorter and stronger than mc. IV. It has something of the general shape of mc. I., though not nearly so massive as that bone. It is compressed proximally, but expands distally. There is a broad, rugose, concave surface on the internal side of the proximal end. The proximal articular surface is crescentic in outline with the upper arm heavier than the lower. There is a deep constriction on the inferior side and another less pronounced on the superior just behind the distal end. The distal articular surface is faintly convex and subcircular in outline.

The manner in which the different elements of the metacarpus interlock at their proximal ends is suggestive of that which obtains in the mammalia and is well calculated to give stability to the manus when supporting the weight of the ponderous body. It will also,

now that the position of each is definitely known, furnish important aid in assigning the various metacarpals when found disassociated to their proper positions. Some of the principal characters of the metacarpals are well shown in plates XIX. and XX. and figs. 4, 11, and 12.

Principal measurements of metacarpals, column 1, greatest length; 2, greatest transverse diameter at proximal end; 3, greatest transverse diameter at distal end; 4, least transverse diameter of shaft.

	1.		2.		3.		4.	
	mm.	in.	mm.	in.	mm.	in.	mm.	in.
Mc. I.	257	10⅛	80	3⅛	103	4	70	2¾
Mc. II.	285	11¼	122	4¾	149	5½	80	3⅛
Mc. III.	285	11¼	110	4½	119	4⅝	70	2¾
Mc. IV.	240	9½	76	3	110	4¼	60	2⅜
Mc. V.	232	9⅛	68	2⅝	110	4¼	57	2¼

Depth of Mc. I. at proximal end,	155 mm.	5⅝ in.
" " " II. " " "	85 "	3¼ "
" " " III. " " "	74 "	2⅞ "
" " " IV, " " "	125 "	4⅞ "
" " " V. " " "	142 "	5½ "

The Phalanges.—The entire series of proximal phalanges are present as is also the second or terminal phalanx of the first digit.

The proximal phalanx of the first digit is longer on the external than on the internal side, so that when in position between the ungual and Mc. I. it appears wedge shaped, with the wedge directed toward the opposite foot. The internal lateral surface is convex and the external deeply concave. The palmar surface is produced posteriorly into a thin sheet which lies under the distal end of mc. I. The proximal articular surface is concave supero-inferiorly and there is a low, broad keel for articulation with the groove in the distal articular surface of mc. I. The distal articular surface is regularly convex supero-inferiorly and concave transversely.

The ungual of the first digit is compressed laterally but deep posteriorly. The internal lateral surface is convex, the external flat. The proximal articular surface has been so much distorted by pressure, due to the position in which it lay when imbedded, that its characters are obscured in the present specimen. The distal extremity is pointed and the entire external surface throughout the distal two-thirds of its length bears evidence of its having borne a powerful claw during the life of the individual.

The proximal phalanx of the second digit is much the largest of the entire series. The proximal articular surface is flat and circular in outline, the vertical and lateral diameter of this end of the bone being equal. Distally this phalanx is much depressed and greatly expanded transversely. The distal articular surface is very broad but shallow and divided by a deep, median, vertical groove into two subequal lateral moieties with smooth convexly rounded surfaces. This phalanx, as well as its metacarpal, has been erroneously considered as belonging to the third instead of second digit of the series by Professor Osborn, as will readily appear by a reference to fig. 7 of that author's paper on the "Fore and Hind Limbs of Carnivorous and Herbivorous Dinosaurs," published as Article XI. of Vol. XII. of the Bulletins of the American Museum of Natural History.

The proximal phalanx of the third digit is short, very much depressed, more especially at the distal end, and expanded laterally. The proximal articular surface is elliptical in outline, slightly concave, with its transverse diameter about double that of the vertical. The distal articular surface is broad, but extremely shallow. There is a broad but very shallow depression in the middle, faintly dividing it into two ill-defined articular areas. The bone is of about equal transverse dimensions throughout its length.

The proximal phalanx of the fourth digit is short and stout, much narrower than that of the third, but not so depressed. Seen from above it appears somewhat wedge-shaped, the length of the external lateral border greatly exceeds that of the internal. The proximal articular surface is slightly concave and semicircular in outline. The distal end is depressed, with an ill-defined articular surface crossed by a shallow, median vertical groove.

The proximal phalanx of the fifth digit is more massive than that of either the third or fourth, but smaller than the corresponding bones of digits one and two. Seen from above, it presents a broadly wedge-shaped superior surface with an extended external lateral margin, while the inner margin is reduced to a sharp ridge where the proximal and distal surfaces converge and meet at an acute angle. The bone is broader and less depressed than either of the two elements last described. The proximal articular surface is irregularly quadrangular in outline, the transverse dimension about double the vertical. Distally there is a poorly defined articular surface.

The principal dimensions of the phalanges found with this limb and manus are given in the following table, in which the measurements given in columns 1, 2, 3 and 4 show respectively the greatest length and greatest breadth, and the greatest depth at the proximal and distal extremities of the different bones.

	1.		2.		3.		4.	
	mm.	in.	mm.	in.	mm.	in.	mm.	in.
1st Prox. Phalanx	75	2⅞	105	4⅛	85	3⅜	83	3¼
2d " "	90	3½	138	5⅜	100	4	75	2⅞
3d " "	67	2⅝	130	5⅛	65	2½	23	1¼
4th " "	68	2⅝	109	4¼	66	2⅝	42	1⅝
5th " "	75	2⅞	125	4⅞	70	2¾	52	2
Ungual of 1st digit	205	8⅛	64	2½	125	4⅞		

The Sesamoids.—A small, oblong rounded sesamoid was found in position on the palmar side, lying between the distal end of mc. III. and its proximal phalanx. There is little doubt that digits II. and IV. at least bore similar sesamoids in the same position, while others may have been interposed between some of the phalanges. It is not at all impossible that the small ossicles mentioned by Osborn and Granger as found associated with other elements of the manus of Diplodocus and referred by those authors to the carpus were in reality phalangeal sesamoids, as is evidently the case with the present ossicle. The maximum lateral dimension of this bone is 60 mm., 2⅜ inches, vertical 26 mm., 1 inch; while the fore and aft diameter exactly equals the vertical.

FIG. 13. Superior view of sesamoid, about one-fourth natural size. (No. 563.)

MANUS OF BRONTOSAURUS ENTAXONIC IN STRUCTURE.

From the above description and the accompanying figures it will readily be seen that the manus of Brontosaurus, like the pes, was entaxonic instead of mesaxonic as has been supposed by Osborn. Digits II. and III. doubtless were provided with a full complement of phalanges terminating in large unguals bearing powerful claws. In digits IV. and V. the number of phalanges was doubtless successively more and more diminished and the terminal of each reduced to a functionless rounded ossicle similar to those found in the same positions on digits IV. and V. of the pes in both Brontosaurus and Diplodocus.

Not only were digits I., II. and III. the only ones provided with a full complement of phalanges, but the metacarpals decrease in strength from the first to the fifth. The whole structure and arrangement of the different elements of the metacarpus and phalanges is especially

modified so that the principal weight of the body was supported, in the manus as in the pes, by the inner side of the foot.

THE MANUS OF DIPLODOCUS AND MOROSAURUS PROBABLY ENTAXONIC IN STRUCTURE.

Considering the many known similarities in the structure of the skeletons of Brontosaurus and Diplodocus there can be little question that the manus in the latter genus was like the pes entaxonic in structure. This would call for a rearrangement of the phalanges of

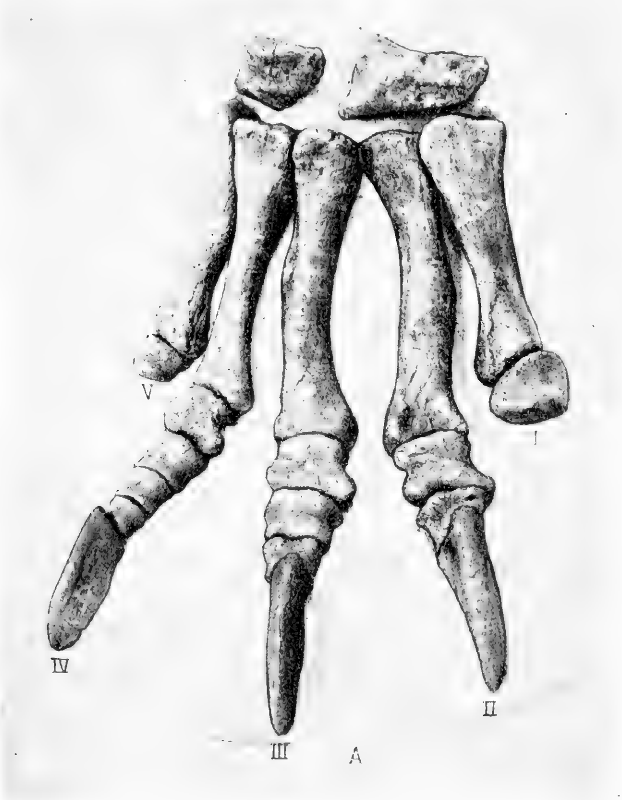


FIG. 14. Right front foot of Morosaurus, one-sixth natural size, after Osborn.

the front feet in the present author's recently published restoration of *Diplodocus carnegii*.[1]

[1] See Mem. of the Carnegie Museum, Vol. I., plate XIII.

I am also strongly inclined to the opinion that the late Professor Marsh was right when in plate XXXVIII. of his Dinosaurs of North America he figured the manus of Morosaurus with digits I., II. and III. provided with claws and IV. and V. deficient in those elements, thus indicating an entaxonic structure of the manus in this genus of sauropod dinosaurs. The Morosaurus manus first described and figured by Osborn,[1] and later associated and figured with a humerus, radius, and ulna by Osborn and Granger does not appear to me as entirely demonstrating the propriety of the arrangement of the phalanges and metacarpals as shown in the figures and described in the text of those authors. A reproduction of Osborn's figure of this foot is given in fig. 14, and I wish especially to call attention to metacarpals II. and III. The curvature of the shafts of these bones as well as the nature of their proximal interarticulation, if their slight contact can be thus designated, is such as to indicate that they pertain to opposite feet. Compare the closely interlocked metacarpals II. and III. shown in figs. 4 and 11 and in plate XX. with the same bones in fig. 14. The arrangement which obtains in the former is well adapted to give the necessary strength and rigidity at that point where it was most needed in the manus of these ponderous beasts, while that of the latter is indicative of weakness and instability at the precise point where stability was to be expected. In short I believe the right foot of Morosaurus as figured by Osborn and Osborn and Granger has the metacarpals and phalanges wrongly placed and that in the figure given by Marsh the arrangement of these elements was essentially correct, although that author may have erred in allowing one or more too many phalanges for digit IV.

SUMMARY.

The chief points regarding the structure of the fore limb and foot of Brontosaurus established in the preceding paragraphs may be summarized as follows:

1. The humerus, radius and ulna are shorter and lighter than the corresponding bones of the hind limbs.

2. The radius and ulna do not cross completely as in the mammalia.

3. The carpus, like the tarsus, consists very likely of a single element—the scapho-lunar.

4. The metacarpals are longer than the metatarsals.

[1] See Bull. Am. Mus. Nat. Hist., Vol. XII., pp. 161–172.

5. The manus, like the pes, is undoubtedly entaxonic in structure in Brontosaurus and very probably so in Diplodocus and Morosaurus.

EXPLANATION OF PLATES.

PLATE XIX.

Palmar view of radius, ulna and manus (No. 563) showing position of bones as they lay imbedded in the matrix. u, ulna; r, radius, x, scapho-lunar; s, sesamoid; metacarpals and phalanges indicated by their respective numerals.

PLATE XX.

Dorsal view of the same. Letters same as above. Both figures a little less than ⅛ natural size.

ARNEGIE MUSEUM, December 28, 1901.

XIV. THE GENERA AND SPECIES OF THE TRACHODONTIDÆ (HADROSAURIDÆ, CLAOSAURIDÆ) Marsh.

By J. B. Hatcher.

In March 1856[1] Dr. Joseph Leidy described under the name of *Trachodon mirabilis* certain teeth pertaining to a herbivorus reptile allied to Iguanodon. These teeth were discovered by Dr. F. V. Hayden in deposits, now generally considered as Laramie, in the "Bad Lands" of the Judith river, in Montana. No figures accompanied Leidy's original description. Three years latter however Dr. Leidy gives a more detailed description of this new genus and species accompanied by excellent figures of the teeth upon which it was founded.[2] Unfortunately Dr. Leidy failed to designate any particular tooth as the type of the genus and species and his figures show that he has included teeth belonging to two quite distinct forms of dinosaurs. Figs. 1–17 represent teeth with simple roots closely resembling the teeth of certain Iguanodont dinosaurs, which by Leidy, Cope, Marsh, and others have since been variously referred to under the names of *Trachodon, Thespesius, Hadrosaurus, Diclonius, Claosaurus,* etc. Figs. 18 to 20 represent different views of a tooth with two roots and of quite a different pattern. This tooth, as we know by later discoveries, belonged to a very different dinosaur pertaining to a family, representatives of which have since been described by Cope and Marsh under various generic names as *Dysganus, Agathaumas, Monoclonius, Ceratops, Triceratops, Torosaurus,* etc.

While Leidy has nowhere designated any of the teeth described and figured in the above mentioned publications as the type of *Trachodon mirabilis,* yet on page 141 of the paper last cited he says: "Of the specimens of teeth referred to Trachodon, the unworn crown is the most important. It is represented in plate 9, figs. 1–3." This may then be very properly considered as the type of the genus and species, while the quite different two-rooted tooth above referred to would

[1] See Proc. Phil. Acad. Sci., 1856, p. 72.

[2] See Trans. Am. Phil. Soc., 2d Ser., Vol. II., pp. 140–143, Pl. 9, figs. 1–16.

pertain to a distinct genus. Moreover this would seem to be the view taken by the late Professor Marsh when in 1890 he described as *Trachodon longiceps* the lower jaw of an Iguanodont dinosaur with very similar, if not identical, simple-rooted teeth.[3] The type of *T. longiceps* was obtained by the present writer in about the same horizon, though in a different locality, as were the teeth described by Dr. Leidy.

In December, 1856, under the name of *Thespesius occidentalis* Dr. Leidy described two caudal vertebræ and a first phalanx of a large dinosaur.[4] These remains were found in the lowest member of the Lignite formation, essentially the same horizon as those from which the teeth were procured.

Two years later or in December, 1858,[5] Dr. Leidy described a third new genus and species of Iguanodont dinosaur under the name of *Hadrosaurus foulkii*. The remains upon which this genus and species were founded were taken from the Cretaceous marls near Haddonfield, New Jersey, and consisted of twenty-eight vertebræ with their processes mostly wanting; a complete humerus, radius and ulna; an imperfect ilium and pubis; a femur, tibia and fibula; two metatarsal bones and a first phalanx, nine teeth and a fragment of the lower jaw. These remains were later more fully described and adequately illustrated by Dr. Leidy.[6] In this paper Dr. Leidy fully realized the very close relationship and probable identity of the genera *Trachodon*, *Thespesius* and *Hadrosaurus* which he had proposed for the reception of these remains from three widely separated localities. On page 84 he says "several of the teeth of *Hadrosaurus* are nearly identical in form and details of structure with the specimen of a tooth discovered a short time previously to the former, by Dr. F. V. Hayden, in the Bad Lands of the Judith River. The tooth just mentioned, together with several other much worn specimens, I referred to a distinct genus under the name of *Trachodon*, but I shall not be surprised to learn that future discovery determined *Hadrosaurus* and *Trachodon* to be the same." While in a footnote on the same page in speaking of *Thespesius* he says, "had the remains of *Thespesius* and *Trachodon* been found in a deposit of the same age I should have unhesitatingly

[3] See Am. Jour Sci., 1890, Vol. XXXIX., p. 422.

[4] See Proc. Acad. Nat. Sci. of Phil., 1856, p. 311, 312.

[5] See Proc. Acad. Nat. Sci. of Phil., 1858, pp. 215–218.

[6] See Cretaceous Reptiles of the United States. Smith. Contr. to Knowledge, 1865, Vol. XIV., pp. 76–97, Plates XII.–XVII.

referred them to the same animal, and I cannot avoid the suspicion that future investigation may determine them to be the same. Should such a determination prove to be the case, the minor details of structure of the tooth of *Trachodon* different from those of *Hadrosaurus*, together with the convexo-concave anterior caudals and the plano-concave posterior caudal of *Thespesius*, in comparison with the biconcave caudals of *Hadrosaurus*, will be sufficient to separate generically the New Jersey Dinosaurian from that of the Upper Missouri." I have already remarked that we are now quite certain that the types of *Trachodon* and *Thespesius* came from essentially the same horizon, but in regard to the relative horizons of the western and New Jersey beds we cannot be so sure. It would seem however that the New Jersey Dinosaur came from a somewhat lower horizon than did the others, and this supposition in connection with the anatomical differences pointed out by Leidy, together with their wide geographical distribution, might be taken to indicate that the remains of *Hadrosaurus* pertained to an animal generically distinct from *Trachodon*. This however can only be determined by a comparison of the remains of *Hadrosaurus* with the more recently discovered skeletons of *Trachodon* which have since been found in the same deposits in the west as were the type specimens, though unfortunately they have been referred to various genera such as *Cionodon*, *Diclonius*, *Claosaurus*, etc.

Three years after publishing his "Cretaceous Reptiles of the United States" Dr. Leidy became fully convinced of the generic identity of *Trachodon* and *Hadrosaurus*. In a communication to the Philadelphia Academy of Sciences in 1868,[7] he says, "*Hadrosaurus Foulkii*, the bulky vegetable feeder, and contemporary of the rapacious *Lælaps aquilunguis*, was at most probably only specifically distinct from *Trachodon mirabilis*, the teeth of which were found in association with those of *Dinodon*, so that, according to the laws of nomenclature, as *Trachodon* has priority of name, I suppose the first mentioned animal must be called *Trachodon Foulkii*, though the names of *Hadrosaurus Foulkii* and *H. mirabilis* would appear more appropriate for these powerful dinosaurs.

"The best preserved tooth of those originally referred to *Trachodon*, represented in Figs. 1–6 of the plate above cited, is identical in form with those referred to *Hadrosaurus*, and differs only in the absence of the rugulations of the lateral borders of the crown, and in some less important points.

[7] See Proc. Phil. Acad. Sci., 1868, p. 199.

"The remaining specimens of teeth referred with the former to *Trachodon*, are represented in Figs. 7–20 of the plate cited. Most of them are so worn and probably altered from their original form, that it is rendered uncertain whether they belong to the same animal as the preceding tooth, and one unworn (Figs. 18–20) has a very different shape from this. Perhaps these specimens belonged to another Dinosaur, for which the name *Trachodon* might be reserved, while that of *Hadrosaurus* might include the first mentioned and more characteristic tooth.

"As *Iguanodon* had its enemy in a species of *Megalosaurus*, *Trachodon*, the representative of the former both in the western and eastern portions of the North American continent was accompanied by an equally bloodthirsty enemy, which may, perhaps, on nearer comparison of corresponding parts, prove to be another species of the same genus, until now supposed to be different, under the names of Dinodon and Lælaps."

From the above quotation it will be seen that Leidy now recognized the distinct nature of the tooth shown in Figs. 18–20 of the plate cited and at the same time considered *Hadrosaurus* a synonym of *Trachodon*. I fail however to see how he can be interpreted as having abandoned the genus *Trachodon*, as Cope later seems to have construed his words.[8]

If Leidy was correct in considering *Trachodon* and *Hadrosaurus* as synonyms, the presence of remains of so highly a specialized genus of the dinosauria in the fresh water Laramie deposits of the West and in the marine upper green sands of the New Jersey Cretaceous would seem to be of considerable importance in reaching a conclusion as to the proper correlation of the Cretaceous deposits of these widely seperated regions.

Two new species, *Trachodon* (*Hadrosaurus*) *minor* and *T.* (*Hadrosaurus*) *tripos*, were proposed respectively by Marsh and Cope in 1870, and described in the Proceedings and Transactions of the American Philosophical Society. In 1871 Cope adds another species, *T.* (*Hadrosaurus*) *cavatus*, describing it in the Proceedings of the American Philosophical Society for 1871. The first of these three species was

[8] See footnote, p. 99, Proc. Phil. Acad. Sci., 1883 and 1876, p. 253. In a later communication (Proc. Phil. Acad. Sci., 1870, p. 68) than that cited by Cope Leidy places *Trachodon mirabilis* as a synonym of *Hadrosaurus mirabilis*, apparently overlooking the fact that Trachodon has priority.

founded on fragmentary lumbar and caudal vertebræ, the last two on poorly preserved caudal vertebræ.

In 1870 Cope proposed the genus and species *Hypsibema crassicauda* for the reception of some caudal vertebræ and fragmentary limb- and foot-bones belonging to one of these dinosaurs which he described in the Transactions of the American Philosophical Society for 1870, and in the Proceedings of the same Society for 1871.

The next genus and species proposed for these dinosaurs was *Cionodon arctatus*[9] Cope, first described in 1874, and founded on a portion of a right maxillary with several teeth in position found in Colorado, no more definite locality being given. In the succeeding year (1875)[10] Professor Cope gave a further description of this genus, adding a new species *C. Stenopsis*, founded on material collected by the late Dr. G. M. Dawson said to be from the Ft. Union beds of the Milk River region, Canada. At that time, as now, the Ft. Union and Laramie deposits were not easily distinguishable, and it is quite probable that this material was from a horizon approximately the same as that of the other material from the West upon which the foregoing genera and species have been proposed.

In the same year Professor Cope proposed still another new genus, *Polygonax*, for these dinosaurs. He described the species as *P. mortuarius*, founded on three dorsal vertebræ and some fragments of limb bones found in Colorado[11] in association with the remains referred to *Cionodon arctatus*.

In 1876[12] the genus *Diclonius* was proposed by Cope for the reception of certain remains of these predentate dinosaurs and three new species, *D. pentagonus*, *D. perangulatis*, and *D. calamarius*, were introduced, based on shed teeth found associated according to that author with those of *Trachodon mirabilis* in the Laramie (Ft. Union) deposits.

On page 99 of the Proc. of the Phil. Acad. of Sci. for 1883, in his "Characters of the Skull in the Hadrosauridæ" Cope, says, "The species on which these observations are based is the *Diclonius mirabilis* of Leidy," and in a footnote he adds, "This species is part of one called by Leidy *Trachodon mirabilis*, who included in it a species

[9] Bull. U. S. G. S. of the Terrs., No. 1, 1875, p. 2.

[10] Vert. of Cre. form. of the West, Rep. U. S. G. S. of the Terrs., Vol. II., 1875, pp. 57–63.

[11] See Rep. on the Vert. Pal. of Col., An. Rep. U. S. G. S. Terrs. for 1873, pub. 1875, pp. 451–452.

[12] See Proc. Phil. Acad. Sci., 1876, pp. 253–255.

of *Dysganus*. He did not characterize the genus *Trachodon*, and afterwards abandoned it. (Proceedings Academy, Phila., 1868, p. 199.)''[13] We have already shown that Leidy had not abandoned the genus and had fully characterized it, accompanying his descriptions with splendid illustrations of the material at his command. There would seem therefore little doubt as to the synonymy of *Diclonius* and *Trachodon*. The splendid skeleton of *Trachodon* (*Diclonius*) *mirabilis* discovered by Drs. Wortman and Hill in the Laramie of South Dakota enabled Professor Cope to more fully characterize that genus than it had been possible for Dr. Leidy to do. A careful comparison between this skeleton and the remains from Haddonfield, New Jersey, of *Hadrosaurus foulkii* should determine whether or not the latter genus is a synonym of *Trachodon*.

Claorhynchus trihedrus[14] was applied by Cope to a rostral and predentary bone (locality and horizon not given) which he considered as pertaining to the *Agathaumidae* but which would appear from the description given to more properly belong to the *Trachodontidae*.

In 1889[15] Professor Cope proposed still another genus and species, *Pteropelyx grallipes* for these dinosaurs, based upon a portion of a skeleton discovered by Mr. J. C. Isaac near Cow Island, Montana, on the Upper Missouri River some forty miles below the mouth of the Judith River. The locality and horizon are essentially the same as those from which Dr. Hayden procured the types of *Trachodon* and there can be no doubt as to the identity of the two genera. In 1892[16] Cope considered *Pteropelyx* and *Claosaurus* as synonyms. In the paper last cited he says (p. 758): "*Pteropelyx Cope*—This genus was described by me in The American Naturalist for October, 1889, p. 904 (published March 5, 1890). It has been subsequently named by Marsh, *Claosaurus*, in the American Journ. Sci. Arts, for May, 1890 (p. 243)." The discovery of more complete material of *Pteropelyx* has shown the identity of that genus and *Trachodon*.

In 1889 Professor Marsh proposed two new species—*Trachodon* (*Hadrosaurus*) *breviceps* and *T.* (*Hadrosaurus*) *paucidens*, founded on fragments of jaws from the Bad Lands on the Judith River, in Montana, the same locality as that which yielded the type of the genus.[17]

[13] See Proc. Phil. Acad. Sci. 1883, pp. 93–107, Plates IV.–VII.

[14] See Am. Nat., 1892, p. 757.

[15] Ibid., 1889, p. 904.

[16] Ibid., 1892, p. 758.

[17] See Am. Jour. Sci., Vol. XXXVII., April, 1888, pp. 335, 336.

In 1890[18] Marsh described a third species *Trachodon longiceps*, already referred to, from the Laramie of Converse County, Wyoming. In the same communication he removed a fourth species which had been described by him in April, 1872,[19] as *Hadrosaurus agilis* from that genus, creating for it a new genus *Claosaurus*. The type of *Claosaurus agilis* according to Marsh came from the Pteranodon horizon of the Niobrara formation, near the Smoky Hill River in western Kansas, and consisted of a considerable portion of the skeleton. From Marsh's description of the parts found and considering the geological horizon in which the remains were discovered there would seem to be little doubt that *Claosaurus agilis* is generically and specifically distinct from any of the preceding genera and should therefore be retained.

In May, 1892, Professor Marsh[20] describes a fifth species of these dinosaurs—*Claosaurus annectens*, founded upon a nearly complete skeleton from the Laramie of Converse Co., Wyoming. It is somewhat remarkable that Professor Marsh should have referred this specimen to this genus considering that the type of *Claosaurus* came from the Pteranodon beds of the Colorado series. It would seem improbable that so highly specialized a genus should have continued uninterruptedly throughout so long a period as that which extended from the Niobrara to the upper Laramie. Whether or not *Claosaurus agilis* and *C. annectens* are generically distinct can alone be determined by a careful comparison of the type specimens. Of the generic identity of *Trachodon mirabilis* of Leidy and Cope and *Claosaurus annectens* there can be no doubt and there is little question but that they are specifically identical. The almost complete skeletons which were described by Cope and Marsh respectively as *Diclonius mirabilis* and *Claosaurus annectens* were found in the same geological horizon and in essentially the same locality, the former northeast of the Black Hills and the latter southwest of the same mountains. Such minor differences as do exist in the two skeletons are due either to distortion as a result of pressure, to individual variation, or at most the little structural differences that are discernible are certainly of not more than specific importance. We have already shown that *Diclonius* is a synonym of *Trachodon*, and *Claosaurus annectens* should there-

[18] See Am. Jour. Sci., Vol. XXXIX., 1890, pp. 422–424.

[19] See Am. Jour. Sci., Vol. III., p. 301, April, 1872.

[20] See Am. Jour. Sci., Vol. XLIII., May, 1892, p. 453.

fore be known as *Trachodon annectens*, restricting for the present the genus *Claosaurus* to the form from the Pteranodon beds, which latter however if eventually shown to be generically identical with *T.* (*Claosaurus*) *annectens*, as Marsh supposed, will then have to be referred to *Trachodon*, resulting in the abandonment of the genus *Claosaurus* as a synonym of *Trachodon*.

Trachodon (*Claosaurus*) *annectens* is further noticed by Professor Marsh in August, 1892,[21] and in October of the same year.[22] In the latter communication he gives a restoration of the skeleton based upon the excellent material at his command. In January, 1893, he gives a description of the skull and brain.[23] In 1890,[24] Professor Marsh proposed for these dinosaurs the family name *Trachodontidæ* to replace the *Hadrosauridæ* proposed by Cope in 1869,[25] to which family these dinosaurs had already been referred. Later he includes in the *Trachodontidæ* only such genera and species as had been proposed by Leidy and Cope, placing the genus *Claosaurus* in a new family, the Claosauridæ[26] on very insufficient grounds. There can be no question concerning the synonymy of the family name *Claosauridæ* with that of *Trachodontidæ*, which is to be preferred to that of *Hadrosauridæ* since the genus from which the latter was derived becomes a synonym of *Trachodon*. It is doubtful, however, whether the family name *Trachodontidæ* should not be abandoned in favor of *Iguanodontidæ*, which has priority and was proposed for the reception of the European forms. Iguanodontidæ would then include both the American and European forms of these closely related dinosaurs.

Following is a list of the various genera and species of Trachodontidæ that have been proposed, with author's name and a reference to the original description of each.

Trachodon mirabilis Leidy, Proc. Phil. Acad. Sci., March, 1856, p. 72.

Thespesius occidentalis Leidy, Proc. Phil. Acad. Sci., December, 1856, p. 311.

[21] See Am. Jour. Sci., Vol. XLIV., August, 1892, pp. 171–173, Plates II. and III.

[22] Ibid., Vol. XLIV , October, 1892, pp. 343–346, Plate VI.

[23] Am. Jour Sci., Vol. XLV., Jan., 1893, pp. 83–86, Plates IV.–V.

[24] Ibid., Vol. XXXIX., 1890, p. 424.

[25] See Proc. Phil. Acad. Sci., 1883, p. 99.

[26] See Am. Jour. Sci., December, 1895, p. 498, and Dinosaurs of North America 16th Ann. Rep. U. S. G. S , p. 244.

Hadrosaurus foulkii Leidy, Proc. Phil. Acad. Sci., December, 1858, pp. 215–218

Hadrosaurus minor Marsh, Proc. Phil. Acad. Sci., January, 1870, p. 2.

Hadrosaurus tripos Cope, Trans. Am. Phil. Soc., 1870, p. 122.

Ornithotarsus immanis Cope, Proc. Am. Phil. Soc., 1889, p. 117.

Hadrosaurus cavatus Cope, Trans. Am. Phil. Soc., 1871.

Hadrosaurus agilis Marsh, Am. Jour. Sci. and Arts, April, 1872.

Cionodon arctatus Cope, Bull. U. S. G. S. Terrs., No. 1, 1874, p. 2.

Cionodon stenopsis Cope, Vertebrata of the Cretaceous Formations of the West; An. Rep. U. S. G. S. Terrs., Vol. II., 1875, pp. 57–63.

Polygonax mortuarius Cope, An. Rep. U. S. G. S. Terrs. for 1873, pub. 1875, pp. 451–452.

Diclonius pentagonus Cope, Proc. Phil. Acad. Sci., 1876, pp. 253–255.

Diclonius perangulatus Cope, Proc. Phil. Acad. Sci., 1876, pp. 253–255.

Diclonius calamarius Cope, Proc. Phil. Acad. Sci., 1876, pp. 253–255.

Hadrosaurus breviceps Marsh, Am. Jour. Sci., April, 1889, p. 335.

Hadrosaurus paucidens Marsh, Am. Jour. Sci., April, 1889, p. 336.

Pteropelyx grallipes Cope, Am. Nat., October, 1889, p. 904–905.

Trachodon longiceps Marsh, Am. Jour. Sci., May, 1890, p. 422.

Claosaurus (Hadrosaurus) agilis Marsh, Am. Jour. Sci., May, 1890, p. 423.

Claosaurus annectens Marsh, Am. Jour. Sci., May, 1892, p. 453.

Claorhynchus trihedrus Cope, Am. Nat., Sept. 1892, p. 757.

A careful examination of the original descriptions and figures of the types of the ten genera and twenty species enumerated above, shows that there should be a great reduction in each and that the ten genera which have been proposed should be reduced to two *Trachodon* Leidy and *Claosaurus* Marsh, while the remaining eight genera should be treated as synonyms of Trachodon, which should also be made to include *T.* (*Claosaurus*) *annectens* Marsh; while the smaller *Claosaurus agilis* described by Marsh from the Kansas chalks may still be considered as pertaining to a distinct genus.

Doubtless many of the species are also synonyms but this can only be determined by a careful comparison of the types.

THE DERMAL COVERING OF TRACHODON.

The writer has recently described and figured certain impressions of the dermal covering of Trachodon preserved in a block of sandstone containing a portion of the pelvic and caudal regions of a skeleton of one of these dinosaurs found in the Laramie deposits of Converse Co., Wyoming.[27] At the same time the claim was made that this was the first published description concerning the dermal covering of dinosaurs. I have since discovered that Professor Cope had already in Dec. 1885[28] published a description with figures of dermal impressions from the same region of the body as those described by the writer and pertaining to the same species *Trachodon* (*Diclonius*) *mirabilis* Leidy.

J. B. HATCHER.

CARNEGIE MUSEUM, PITTSBURG, PA.,
Sept. 28, 1901.

[27] See Science, N. S., Vol. XII., Nov. 9, 1900, pp. 719-720.
[28] See Am. Naturalist, Vol. XIX., p. 1208, XXXVII.

SOME NEW PENNSYLVANIAN THORNS.

By W. W. Ashe,

Raleigh, N. C.

Cratægus arcuata sp. nov. A slender tree 5–7 m. in height with rather few erect or ascending branches forming an open oblong crown and a short trunk, often 1 dm. thick, sparingly armed with compound thorns; the bark on the trunk dark gray and broken into small scales, that on the branches ashen-gray and smoother. Twigs at first pubescent, at length glabrate, red-brown, sparingly armed with short thorns 3–4 cm. long; the wood soft and white. The leaves when young are appressed pubescent on the upper surface and on the lower surface on the principal veins; when mature they are glabrous above, and below except in the axils of the veins, membranaceous, dark green above, pale below, the blades broadly ovate or nearly orbicular in outline, 8–11 cm. long, 6–10 cm. wide, abruptly acute at apex, rounded, truncate, or subcordate at base, coarsely and sharply double serrate, with 2–3 pairs of short lateral lobes, the lowest with reflexed tips, 4–6 pairs of slender divergent primary veins, the lowest pair arcuate at the tips. Inflorescence a few-branched, 4–15-flowered, wide-spreading, 5–9 cm. wide villose corymb, the stout elongated pedicels mostly 3-forked and 3-flowered. The flowers, which appear about the middle of May, though the flowering period is prolonged, are from 20–25 mm. wide, cup-shaped and on nodding pedicels; calyx villose, cup-shaped, the very narrow 5–7 mm. long serrate villose lobes spreading after anthesis; stamens 5–8, usually 5, anthers pink. The fruit, borne in few-fruited clusters on long pendent slightly villose or glabrate pedicels, is oblong-globular, about 13 mm. long, 11 mm. thick, rounded at apex, slightly concave at base, scarlet, or mottled with orange and russet, shining, glabrous or pubescent at apex, and capped by the elongated spreading or reflexed brown lobes.

Cratægus arcuata is common in parts of eastern Pennsylvania along streams and in meadows and is often associated with the white ash and American linden. It is related to *C. Holmesiana* Ashe (Journ. E.

Mich. Sc. Soc., 16: p. 2: 78), from which it is separated by the villose pedicels and globular fruit; while from *C. pedicellata* Sarg. it is separated by the larger flowers, fewer stamens and larger foliage; and from *C. villipes* Ashe (*C. Holmesiana villipes* Ashe, Journ. E. Mich. Sci. Soc., 17: p. 2: 11) by the broader foliage, more globose fruit and spreading calyx lobes. The type material was collected in Berks county, Pennsylvania, by Prof. C. L. Gruber and W. W. Ashe.

CRATÆGUS GRUBERI n. sp. A low bushy tree 3–4 m. in height, dividing near the ground into numerous ascending flexuous branches; the bark on the short trunk ash-gray, broken into small thin loose scales and armed with numerous simple or compound gray thorns; that on the branches smooth and lighter gray. Twigs glabrous, red-brown, slender, nearly straight, armed with numerous slender straight or curved spreading thorns. Leaves at first minutely pubescent above, soon glabrous on both surfaces, dark green, thin and firm, the blades ovate or broadly ovate, 4–8 cm. long, 4–6 cm. wide, acute at apex, truncate, rounded, or rarely acute at base, sharply doubly serrate, with 2–3 pairs of shallow notches; petiole slender, 2–3 cm. long, grooved on the upper side, with 2–3 pairs of glands near apex. The flowers, which appear when the leaves are about one-half grown, from the middle to the twentieth of May, in 6–12-flowered glabrous nearly simple 5–8 cm. wide cymes, are 17–20 mm. wide, cup-shaped and on several-bracted glabrous pedicels 1–3 cm. long; calyx obconic, glabrous, the lobes triangular from a broad base, entire; stamens usually 5, seldom 6, anthers pink; styles 2–3 or rarely 4. The fruit, solitary or in simple few-fruited clusters on spreading pedicels, is globular-pyriform, 13 mm. long, 11 mm. thick, light green with russet or scant scarlet blotches, capped by the persistent incurved lobes; ripens early in October and falls with or before the foliage; flesh hard and green; seed 2 or 3-grooved on the back, the lateral faces plane.

Fields, Berks county, Pennsylvania, where collected in May and September, by Prof. C. L. Gruber, who has allowed me to associate his name with the plant.

CRATÆGUS TENELLA n. sp. A tree 5–7 m. in height with spreading branches forming an oval crown; the bark on the sparingly armed trunk dark gray and broken into small scales, that on the branches lighter and smooth. Twigs slender, chestnut brown, armed with long slender slightly curved chestnut thorns 4–5 cm. long. Leaves

membranaceous, glabrous on the lower surface, at first pubescent above with short appressed hairs, soon glabrous and smooth, dark green above, much paler beneath, ovate or oval, 5–7 cm. long, 4–6 cm. wide, acuminate at the apex, rounded at the base, sharply and coarsely serrate, 3–4 pairs of short ascending lobes, 4–6 pairs of slender ascending primary veins; petiole slender, 2–3 cm. long, roughened with a few glands. The flowers, which appear the middle of May, in large, compound, many-flowered glabrous corymbs are about 18 mm. wide; calyx obconic, glabrous, the narrow entire ligulate lobes reflexed after anthesis; stamens 5–8, anthers dark pink. The fruit, which ripens the middle to the last of September, borne in large compound clusters on pendent pedicels, is oblong, about 13 mm. long, dark orange or scarlet or mottled with both colors, and capped by the narrow reflexed lobes, or the lobes are deciduous; cavity small and shallow; seed 6–7 mm. long, 3–4.

The type material, collected by W. W. Ashe, is from Delaware county, Pennsylvania.

Cratægus crocata n. nom. *C. punctata* var *aurea* Ait, Hort. Kew. Ed. 1, ii, 170 (1789) not *C. aurea* Marsh. Arb. Am. 89 (1785). The *C. xanthocarpos* of Medicus (Gesch. 85 (1829)) probably also refers to the yellow-fruited *punctata* but the specific name *xanthocarpos* was previously applied by Linnæus to quite a different thorn.

This is the yellow-fruited *punctata* of the middle Atlantic and Lake States, and is not uncommon throughout Pennsylvania, assuming the same habit as the red-fruited plants. Like *punctata* it is a 20-stamened species, but the anthers are often nearly white, the fruit golden-yellow, glossy, not, or sparingly punctate, the flesh firm and juicy, greenish-yellow; seeds usually three, while four are commonly formed in *punctata*. The bark is lighter, and the foliage brighter and more lobed at the apex than in *punctata*.

Cratægus fœtida n. sp. A shrub 1–2 m. in height, often with several stems from the same root, and ascending nearly straight branches which begin near the ground. Twigs red-brown, glabrous, armed with very numerous slender long spreading thorns 3–4 cm. Leaves at first with few short appressed hairs on upper surface, soon glabrous, thick, firm, dark green above, much paler beneath, the blades ovate, or broadly ovate, 5–7 cm. long, 4–6 cm. wide, acute at apex, rounded or acute at the entire base, sharply doubly serrate, often sparingly notched; petiole flattened, 1–2 cm. long, winged by

the decurrent blade, and roughened with several pairs of glands. Inflorence a glabrous cyme, 2–6-flowered 3–5 cm. wide; the stout, nearly or quite glabrous, pedicels erect 1–2 cm. long. Flowers ill-scented, 16–18 mm. wide, saucer-shaped; calyx glabrous, cup-shaped, the short lobes, 4–5 mm. long, narrowly triangular from a broad base, entire or sparingly serrulate, reflexed after anthesis; stamens 10, large, the disk broad and sparingly pubescent within, anthers cream colored; petals broader than long, on an evident claw; styles 3–5, generally 4. The fruit, borne in simple, few-fruited clusters, is subglobose, usually thicker than long, 11–14 mm. thick, slightly concave at base, dull olive-green, mottled with brick red and russet, capped by the short-stalked calyx, the triangular reflexed entire lobes persistent; seed usually 4, very thick, deeply grooved on the back; cavity broad and deep; flesh green, sour; ripening early in October and falling soon after the leaves.

C. L. Gruber and W. W. Ashe, Berks county, Pennsylvania.

CRATÆGUS PAUSIACA n. sp. A tree 5–8 m. in height with thin dark gray-brown scaly bark and long horizontal branches forming a globose or flat-topped crown. Twigs rather stout, glabrous, or at first sparingly pubescent, those of the season light brown or russet, becoming ash-gray the second year, armed with slender brown thorns 3–4 cm. long. Leaves thick and firm, glabrous, dark green and lucid above, much paler below, obovate or spatulate in outline, or on vigorous shoots nearly orbicular, 4–6 cm. long, 3–5 cm. wide, rounded or abruptly acute at the apex, cuneate at the entire base, sharply and finely serrate above the middle, very slightly but regularly notched, 5–7 pair of prominent deeply impressed ascending parallel veins; petiole glabrous, short, .5–2 cm. long, broadly winged above by the decurrent blade. The flowers, which appear early in June in large many-flowered wide-spreading pubescent corymbs, are about 16 mm. wide, and on stout elongated glabrous or appressed pubescent pedicels; calyx narrowly obconic, the tube glabrate, the ligulate entire lobes appressed pubescent, reflexed after anthesis; stamens 10–16, large, anthers pink; styles 2. The fruit, borne in large compound clusters, on elongated drooping pedicels, is oblong or slightly pyriform, crimson, slightly pruinose, capped by the persistent closely-seated reflexed calyx-lobes; flesh greenish-white, hard and firm; seed 2–3, large and coarse, 7–8 mm. long.

The species above proposed has a wide distribution in Pennsylvania

and will probably prove to be a common plant when better known. It has been collected by J. A. Shafer, in Allegheny county; W. W. Ashe, in Bucks county, and B. H. Smith, in Delaware county. While preferring the rich moist soils near streams, it yet occurs on dryer uplands. It is related to *C. punctata* Jacq., from which it is separated by the lighter colored anthers, and fewer stamens and seed, and more lucid foliage; and to *C. porrecta*, proposed below, from which it is separated by the different outline of the foliage, more oblong fruit and fewer seeds. The large glossy foliage of *C. pausiaca* renders it a conspicuous and handsome tree.

CRATÆGUS PORRECTA n. sp. A tree 6–8 m. in height with a trunk often 1 dm. thick, and long horizontal branches forming a globose or flattened crown; the bark on the trunk dark gray, and broken into thin, broad plates; that on the branches smooth and light gray. Twigs stout, glabrous, nearly straight, bright brown, armed with rather few short, slender thorns, 3–4 cm. long. Leaves thick and subcoriaceous, glabrous, dark green above, somewhat paler beneath, obovate or spatulate, 5–9 cm. long, 3–4 cm. wide, rounded or abruptly acute at the apex (or on vigorous shoots lobed and acuminate) cuneate and entire at base, and gradually narrowed into the winged petiole, 1–2 cm. long, sharply and doubly serrate above the middle with ascending teeth, 5–7 pairs of straight parallel ascending veins, prominent below and deeply impressed above. The flowers, borne in large compound many-flowered glabrous or slightly pubescent corymbs on nodding pedicels, are 15–17 mm. wide; calyx-lobes linear, entire, glabrate, reflexed after anthesis; stamens 8–14, slender, anthers pale pink; styles 2–3. The fruit, borne in large compound clusters on drooping pedicels, is globose or slightly oblong, 15–19 mm. long, sparingly pruinose, dull dark red, and capped by the slender spreading calyx-lobes, ripening late in October and falling after the leaves and while the flesh is yet green; cavity deep and narrow; flesh hard, green, bitter; seed 2–3, 7–9 mm. long, somewhat ridged on the back.

This plant, like *C. grandis* Ashe (Journ. E. Mitch. Sci. Soc. 17: p. 2: 9) has many characters which are intermediate between the *crus-galli* and *punctata* groups, and it is referable to either. It is common on dry slopes around Pittsburg, Pennsylvania, where it has been collected by J. A. Shafer and W. W. Ashe.

CRATÆGUS PREMORA n. sp. A shrub 1–1.5 mm. in height with numerous ascending branches from near the base of the stem. Twigs

very slender, gray pubescent, brown or greenish, becoming gray and glabrous the second year, armed with few very slender 2–3 cm. long thorns. Leaves membranaceous, dark green and pubescent above with short hairs, paler and rough pubescent beneath, the blades ovate or broadly ovate in outline, 5–7 cm. long, 4–5 cm. wide, acute at apex, rounded obtuse or truncate at base, finely and sharply serrate, 3–5 pairs of regular shallow notches; petiole stout, 1–1.5 cm. long, pubescent, glandular, winged above, flattened. The flowers, which appear about June 1st, in 2–4-flowered narrow, villose cymes, 4–5 cm. wide, are 16–20 mm. wide, saucer-shaped, ill-scented, and on short erect pedicels; calyx obconic, villose, the lanceolate, deeply glandular serrate lobes reflexed after anthesis; stamens 10, small, anthers cream-colored; styles 3. The fruit, borne in 2–4-fruited clusters on short, erect strict pubescent pedicels, 1–2 cm. long, is globular, about 1.2 cm. long, full and rounded at both ends, pubescent, especially at the ends, bright green with darker spots, capped by the broad elongated calyx-tube (rarely with the brown reflexed lobes persistent), ripening and falling after the leaves in the middle of October; flesh green, hard, bitterish; seeds 3, deeply grooved on the back, the lateral faces plane.

Cratægus premora can be separated from *C. modesta* Sarg, to which it is evidently related by the different outline of the foliage and the shorter pedicels. Collected in the eastern part of Berks county, Pennsylvania, by C. L. Gruber and W. W. Ashe.

CRATÆGUS CRISTATA n. sp. A small tree 4–8 m. in height with a short stout unarmed trunk often 1 dm. thick, and numerous spreading or ascending branches forming an oval crown; the bark on the trunk dark brown, broken into long thin close layers, inner bark bright orange; that on the flexuous branches smooth, bright olive-green or grayish. Twigs stout, glabrous, flexuous, olive, orange, or brown-purple, becoming gray the third year, armed with numerous rather stout nearly straight red-brown thorns, 3–4.5 cm. long, the wood soft and brittle. Leaves large, bright green, rather thin, at maturity rough on both surfaces, on unfolding appressed pubescent above, soon glabrous, ovate or broadly ovate, 6–8 cm. long, 5–7 cm. wide, rounded or cordate at base, acuminate at the apex, sharply and coarsely serrate nearly to the base, 4–6 pairs of sharp notches, 6–8 pairs of slender primary veins, the lower pairs arched and with spreading or recurved tips, the upper ascending but the tips recurved,

turning dull yellow and falling the middle of October before the fruit; petiole slender, teeth, 2–4 cm. long, grooved above. The flowers, which appear the last of May in large many-flowered compound glabrous corymbs, are 16–22 mm. wide, cup-shaped and on slender elongated glabrous drooping pedicels; calyx glabrous, the large glabrous triangular lobes sharply serrate, ascending after anthesis; stamens 5–8, large, anthers rose-purple. The fruit, borne in glabrous, 1–several-fruited often compound clusters on long, spreading or nodding or pendant pedicels, 2–3 cm. long, is globose or pyriform, 15–17 mm. long, 15–20 mm. thick, full and rounded at the apex, rounded or narrowed at the base, scarlet or darker, lustrous, capped by the persistent ascending or erect lobes which color with the fruit; cavity small, the opening nearly closing as the fruit matures; flesh thick, dry and mealy, deep orange, with an unpleasant flavor; ripening in October and falling after the foliage; seed usually 3, dark-brown, 7–8 mm. long, grooved on the rounded back.

Cratægus cristata is frequent in the vicinity of Pittsburg, Pennsylvania, preferring meadows and fresh soils, where it has been collected by J. A. Shafer and W. W. Ashe. It is most closely related to *C. Holmesiana* Ashe, from which it is separated by the thicker, more globular fruit and different leaf-outline.

CRATÆGUS BRUMALIS n. sp. A small tree 4–6 m. in height, with a short, slender, sparingly armed trunk, seldom more than 1 dm. thick, and numerous ascending branches forming an oval crown; the bark on the trunk dark gray-brown, firm, with shallow furrows; that on the branches dull gray, or olivaceous, and smooth. Twigs stout, orange to dark green, becoming gray the second year, flexuous, armed with very numerous chestnut thorns, 3–4 cm. long. Leaves membranaceous, dark green above, much paler beneath, on unfolding pubescent above, soon glabrous, oval, ovate, or nearly orbicular in outline, 5–7 cm. long, 4–7 cm. wide, abruptly acute at the apex, truncate, rounded or broadly cuneate at base, sharply and finely doubly serrate nearly to the base, 3–4 pairs of short broad notches, the lowest broadest and spreading; petiole nearly terete, slender, 2–4 cm. long, narrowly winged above. The flowers, which appear the last of May in glabrous small compound many-flowered corymbs, are about 16 mm. wide, and borne on slender drooping pedicels; calyx obconic, glabrous, the narrow serrate or entire lobes reflexed, or spreading after anthesis; stamens normally 10, slender; styles 3–4. The fruit, borne in small compound

clusters, of 2–8, on short drooping, very slender pedicels, 1.5–3 cm. long is subglobose, flattened at the apex, very slightly rounded at the narrowed or depressed base, dull, rather dark red, often slightly mottled with green, ripening in October and falling long after the leaves; lobes persistent, spreading and reflexed, or erect, the margins involute at base, the serrate tips connivent; cavity broad and shallow; flesh soft or mealy, sweet, white; seed 3–4, 7–8 mm. long, 5–7 mm. across the deeply sulcate rounded back, lateral faces plane, apical in fruit.

C. brumalis has been collected in the vicinity of Pittsburg, Pennsylvania, where it is not uncommon, by J. A. Shafer and W. W. Ashe. It can be separated from *C. pastorum* Sarg., to which it is most closely related, by the different outline of the foliage and the larger and coarser seed.

CRATÆGUS PENNSYLVANICA n. sp. A tree 5–10 m. in height, with numerous long spreading and ascending branches forming an oval or globose crown, the trunk sometimes 4 m. long and 2 dm. thick, unarmed, covered with dark brown, firm, furrowed bark, the inner bark a bright orange; that on the branches smoother and gray-brown. Twigs stout, bright brown, orange, or olive, at first pubescent, soon glabrate, only the most vigorous shoots armed with a few ascending thorns, 4–5 cm. long. Leaves membranaceous, bright light green, on unfolding densely villose below, less so above, becoming glabrate above, and remaining pubescent below only on the veins, broadly ovate or deltoid in outline, 5–8 cm. long, 4–7 cm. wide, acute at apex, rounded, truncate, or on vigorous shoots cordate at base, 4–5 pairs of short ascending lobes, sharply serrate, nearly to the base, 5–7 pairs of slender ascending primary veins; petiole at first villose, at length glabrate, 2–5 cm. long. The flowers, which appear about the middle of May, in large loose compound villose corymbs, are about 20 mm. wide; calyx villose as are the oblong coarsely serrate lobes which are soon glabrate; styles 4–5; stamens 10, anthers nearly white. The fruit, borne in large loose compound clusters on villose pendent pedicels, is subglobose, usually thicker than long, 16–18 mm. thick, nearly glabrous, scarlet, capped by the large ascending lobes; flesh orange, sweet, very thick; cavity broad, deep and cylindrous. The fruit ripens and falls late in September or early in October before the leaves, which persist until those of most other species have fallen, late in October. The Pennsylvania thorn belonged to the 10-stamened section of the *mollis* group, and is most closely related to *C. Arnoldiana*

Sarg., from which separated most easily by having fewer thorns and the late ripening fruit. The typical material is from near Pittsburg.

CRATÆGUS POPULNEA n. sp. A tree 4–6 m. in height with a slender sparingly armed trunk, seldom 1 m. thick, and numerous short horizontal branches forming a small oval crown; the bark on the trunk gray, broken into small scales, that on the branches lighter and smooth. Twigs red-brown, becoming gray and warty the second year, the wood soft, glabrous, armed with short, thick chestnut or gray thorns, 2–3 cm. long. Leaves thick and firm, dark green, and at first appressed pubescent above, soon glabrous, paler and glabrous below, the blades ovate, 5–6 cm. long, 4–5 cm wide, rounded at the serrulate base, acuminate at the apex, coarsely serrate, 2–3 pairs of shallow notches; petiole 2.5–3 cm. long, stout, roughened, with a few glands. The flowers, which appear about May 20th in large, 6–12-flowered, compound nearly or quite glabrous wide-spreading, corymbs, 5–7 cm. wide, are 16–20 mm. wide, and borne on nodding slender pedicels; calyx glabrous or puberulent, the elongated, entire, or serrate triangular lobes spreading after anthesis; stamens normally 10, often 5, anthers purplish pink. The fruit, borne in small mostly simple clusters, is globular, or oblong, slightly concave at the ends, about 1.4 cm. long, dull red, mottled with green, russet, and scarlet, and capped by the long spreading or ascending lobes; cavity broad and shallow; seeds usually 4, scarcely grooved on the narrow back; flesh thin, firm, yellowish. The fruit ripens early in October and falls after the foliage.

Banks of streams, Berks county, Pennsylvania, C. L. Gruber and W. W. Ashe.

CRATÆGUS EBURNEA n. sp. A small tree 3–6 m. in height with a short trunk, seldom more than 1 dm. thick and long horizontal branches, forming a round or flattened crown; the bark on the trunk dark gray, broken into thin oblong scales, often beset with large compound thorns; that on the branches smooth and lighter gray. Twigs slender glabrous brown-gray, nearly straight, armed with numerous slender gray thorns 3–4 cm. long. Leaves thick and firm, glabrous, dark green and lucid above, paler beneath, obovate elliptic or broadly spatulate in outline, 4–6 cm. long, 2–3 cm. wide, rounded, or on vigorous shoots pointed at the apex, cuneate at the entire base, finely serrate above the middle, with 6–8 pairs of slender, inconspicuous parallel ascending primary veins; petiole very short. The flowers,

which appear the first or second week in June, when the leaves are nearly full grown, in large many-flowered compound glabrous corymbs, are about 17 mm. wide and on slender nodding pedicels; calyx narrowly obconic, glabrous, the narrow triangular lobes entire; stamens 8–10, slender, anthers white; styles 1–2. The fruit, which ripens early in October, in large compound clusters on drooping pedicels, is subglobose, about 13 mm. thick, dull dark red, and capped by the persistent spreading lobes; flesh hard, green, or white; seeds oblong, generally 2, the backs rounded.

Separated from the other eastern plants which have been associated under the name of *C. crus-galli* by the white anthers and broader foliage. Probably common throughout the mountains from eastern Tennessee to Pennsylvania. W. W. Ashe, Glade Springs, Virginia; J. A. Shafer and W. W. Ashe, Pittsburg, Pennsylvania.

CRATÆGUS VIRELLA n. sp. A shrub forming thickets 3–5 m. in height with numerous ascending stems and slender dark brown twigs armed with numerous slender chestnut brown thorns 4–5 cm. long. Leaves firm, dark green and glabrous above, much paler and rough pubescent beneath especially on the veins, often nearly glabrous at maturity, ovate or broadly ovate, 4–6 cm. long, 3–5 cm. wide, rounded or cuneate at the base, acute at apex, sharply and coarsely serrate, 2–3 pairs of shallow notches, 3–4 pairs of prominent veins; petiole 2–3 cm. long, broadly winged above by the decurrent blade. The flowers which appear the last of May, in nearly simple few-flowered pubescent or nearly glabrous cymes, are about 17 mm. wide; calyx-lobes broadly triangular, serrulate, ascending after anthesis, stamens 20; styles 3–5. The fruit, borne in simple, 2–5-fruited clusters, on erect or ascending nearly or quite glabrous pedicels, is depressed globose, concave at base, flattened at the apex, about 1.2 cm. long, 1.3 cm. thick, more or less angled by the seed, glabrous, sparingly pruinose, yellowish green, blotched with pink, olive or russet, capped by the short erect calyx-lobes; flesh firm, hard, green and bitter; seeds usually 5, 6–7 mm. long, scarcely grooved on the back; cavity broad and deep. The fruit ripens in October and falls after the leaves, some of it persistent until November.

C. virella is probably most closely related to *C. pruinosa* Wend. from which it is separated by its smaller size, depressed green fruit and pubescence. Fields and banks, Berks county, Pennsylvania, C. L. Gruber and W. W. Ashe.

CRATÆGUS CICUR n. sp. A small slender tree 2–3 m. in height, or generally a tall virgate shrub with thick rough black cross-checked bark like that of a black haw, the short slender ascending branches with smooth light gray bark. Twigs glabrous, very slender, purple-brown, like the trunk, unarmed. Leaves very thin and soft, glabrous, dark green above, paler beneath, oblong or oblong-ovate, 5–8 cm. long, 4–5 cm. wide, acute at apex, cuneate, or rounded at base, sharply and finely serrate, 4–6 pairs of short lateral spreading lobes, 5–7 pairs of slender arcuate primary veins, spreading or drooping on the purple petiole 1–2 cm. long, turning a dull purple or bronze and falling or withering on the tree during the first half of October; petiole narrowly winged, roughened with stalked glands. The flowers, which appear the last of May in small compound glabrous corymbs, are about 16 mm. wide and borne on erect or ascending pedicels; calyx obconic, glabrous, the narrowly triangular serrate lobes reflexed after anthesis; stamens 5–8, small; styles generally 4. The fruit, borne in few-fruited, mostly simple, short-pedicelled clusters, is pyriform, about 13 mm. long, and 11 mm. thick, light reddish-brown or russet, with much yellow, green, and red, rounded at the apex, narrowed at the base, capped by the persistent lobes borne on the projecting tube, the lobes narrowly triangular, serrate above the middle, reflexed, becoming dull purple or wine colored with the ripening fruit; cavity deep and narrow, hairy at base; flesh firm, pale yellow, or green, sweetish; seeds generally 4, apical, thick and coarse, 7–8 mm. long, deeply sulcate on the rounded back. The fruit ripens in October and falls after the leaves.

Sunny woods, New River, Ashe county, North Carolina, W. W. Ashe; Pittsburg, Pennsylvania, J. A. Shafer and W. W. Ashe.

CRATÆGUS SHAFERI n. sp. A bushy shrub 1–2 m. in height, with numerous ascending branches from near the ground; twigs slender, glabrous, chestnut brown, sparingly armed with slender purple-brown thorns 4–5 cm. long. Leaves membranaceous, at first villose on petiole, and midrib above and veins beneath, at length glabrate, dark green above, paler beneath, ovate or nearly orbicular, rounded or truncate at the base, abruptly acute at the apex, 4–6 cm. long, 3–5–6 cm. wide, 2–4 pairs of short lateral notches, sharply and finely serrate; petiole short, stout, 1–2 cm. long, roughened at apex with several dark brown glands. The flowers, which appear about the middle of May when the leaves are one half grown, in glabrate or somewhat pubes-

cent nearly simple 3–6-flowered cymes, are about 20 mm. wide; calyx glabrous, cup-shaped, the short triangular entire or finely serrate lobes spreading or reflexed after anthesis; stamens 20, anthers white; styles 3–4. The fruit, borne in nearly simple few-fruited clusters on glabrate spreading pedicels, is subglobose, 14–16 mm. thick, not quite so long, dark red or mottled with green, sparingly pruinose and capped by the persistent reflexed lobes; seeds 3–5; flesh hard, white or pink. The fruit ripens early in October and falls after the leaves.

Collected near Carnot, Allegheny county, Pennsylvania, by Mr. J. A. Shafer, of the Carnegie Museum.

CRATAEGUS VIATICA n. sp. A tree 3–7 m. in height with numerous long spreading and ascending branches forming an oval crown, the slender trunk seldom 1.5 dm. thick; bark on the trunk dark gray, broken into thin scales and beset with numerous gray thorns, that on the branches gray and smoother. Twigs stout, straight, glabrous, olive-green or russet, becoming gray the third year, armed with numerous slender chestnut thorns 2–3 cm. long. Leaves glabrous, thick and firm, dark green above, paler beneath, the blades ovate or broadly ovate or deltoid in outline, 5–7 cm. long, 4–7 cm. wide, acute at the apex, rounded, truncate or obtuse at the base, sharply serrate, 3–5 pairs of shallow lobes; petiole slender, 3–5 cm. long. The flowers, which appear the last of May in many-flowed glabrous cymes, are about 18 mm. wide, and on nodding pedicels; stamens 20, styles 3–4. The fruit, which ripens late in October in many-fruited clusters on nodding pedicels, is globose, about 15 mm. thick, dull green, mottled with pink and russet, pruinose, and capped by the broad, short obtuse, deeply serrate lobes; flesh hard and green; seeds 4–5, thick and coarse.

Common in fields, roadsides, and waste land around Pittsburg, Pennsylvania, J. A. Shafer and W. W. Ashe. Related to *C. pruinosa* Wild., from which it is separated by the green fruit, larger and broader foliage and obtuse calyx lobes.

XVI. OSTEOLOGY OF THE PSITTACI.

By Dr. R. W. Shufeldt.

In the Journal of Anatomy and Physiology of London for April, 1886 (Vol. XX, Part III, Art. No. IV, pls. X, XI, pp. 407–425). I published a very full account of the osteology of the Carolina Paroquet (*Conurus carolinensis*), it being illustrated by two lithographic plates including eighteen figures. Since then I have carefully revised this memoir and incorporated in it osteological notes I have made upon certain Cockatoos, Macaws and their allies, while to the contribution as a whole there has been added my review of the skeleton of a specimen of that remarkable bird known as the Owl Parrot (*Stringops*). The figures illustrating my original article upon the skeleton of *Conurus* were all from the specimen of a male bird, and those desiring to see the morphology of the bones of this paroquet illustrated in this way are referred to the Journal of Anatomy, *loc. cit.* Only the skull and trunk skeleton of a female individual are to be found on a plate in connection with the present memoir. There are here figured in the plates in addition, however, one or two interesting skulls, a trunk skeleton and other bones of other species of *Psittaci* that it is believed will be of value in illustrating the text.

Various classifications at different times have been proposed for this well circumscribed group of birds, including, as has just been said, the Parrots, Macaws, Paroquets, and their allies. In the best of these the *Psittacidæ* have invariably been recognized as constituting a family easily to be characterized, and apparently one of marked naturalness.

The suborder is a comparatively large one, containing, according to recent authorities, somewhere in the neighborhood of 450 species. In the United States the *Psittacidæ* are represented at the most but by two species. One of these, now upon the road to rapid extinction in this country, has already been mentioned, it being *Conurus carolinensis*, (Carolina Paroquet), found at the present time only in certain restricted areas in the Gulf States and the Lower Mississippi Valley. To this species, Ridgway also claims for our fauna the form known as

Rhynchopsitta pachyrhyncha (Thick-billed Parrot), as occurring in southwestern Texas and southern New Mexico.[1]

Avian taxonomers and ornithotomists still entertain considerable doubt as to the position of the *Psittaci* in the system, and much painstaking labor is yet required before we can gain any exact knowledge of their true affines. This applies also to the classification of the Parrots among themselves as an isolated group. Studies of the morphology of a great many of the species is what we stand particularly in need of; and this in some cases (*Strigops*) also demands to be supplemented by a research into their embryology.

Before presenting the osteological characters of *Conurus carolinensis* and other forms, we will submit here some of the opinions of leading ornithotomists having reference to the taxonomy of the *Psittaci* as a group, and of the probable relation of this group to others of the Class. Some of the earlier systematists, as Bonaparte and others, placed the *Psittaci* above all other birds, claiming for them the first place in the Class.

Professor Huxley created for them his *Psittacomorphæ* as one of the best defined groups of the order *Carinatæ*. He has said of them that "all the Parrots present wonderfully uniform cranial characters" and that they "constitute one of the best defined groups of birds, having affinities, though of no very close character, with the Actomorphæ and the Coccygomorphæ."

In this morphological characterization of the *Psittacomorphæ*, he tersely presents us with some of the most striking anatomical peculiarities of Parrots, and these are sufficiently well known now to obviate the necessity of recapitulating them in the present connection.[2]

Ten years later Professor Parker said that "The desmognathous *Parrots* are very uniform, having the most complete cranio-facial cleft, with a perfect hinge-joint between the frontal and nasal regions.

[1] Ridgway, Robert. A Manual of North American Birds, 1887, p. 269. In this work it would seem that I am made responsible for this parrot having been observed in southern New Mexico. My knowledge of this rests upon the statement made to me by a captain of cavalry, U. S. Army, who commanded a scouting party in southwestern New Mexico in 1886 or 1887, who, when in camp just north of the Mexican line, noticed one morning "in the trees near his tent a flock of green parrots that had very large bills, and which were very noisy."

[2] Huxley, T. H. On the Classification of Birds; and on the Taxonomic Value of the Modifications of certain of the Cranial Bones observable in that Class. P. Z. S., London, 1867, pp. 415–472.

There is no vomer; the palatines are vertically elongated posteriorly, while anteriorly they are horizontally flattened, and movably united with the rostrum. The lachrymal and postorbital (or sphenotic) bend towards one another, and unite by the intervention of a large os uncinatum or antorbital. In some also the temporal fossa is bridged over by the union of the zygomatic process of the squamosal with the os uncinatum. The nasal septum is a thick wall of bone; an annular ossicle is found in the alinasal cartilage of *Melopsittacus undulatus;* in *Palæornis torquata* this part is largely ossified and anchylosed to the upper jaw, and the alinasal turbinal is partly calcified."[3]

Prior to this, however, that is in 1874, the late Professor Garrod had examined certain sets of anatomical characters in no less than 82 species of Parrots, and in that year he published in the Proceedings of the Zoölogical Society of London the results of his labors. Masterly as this work is, his classification of the *Psittaci* based upon it, is quite artificial, and hardly deserves adoption, except in a few of the points he makes. This is chiefly due to the fact that he ignored much of the osteology in the various species, and only paid attention to a few sets of morphological characters.[4]

Prof. Alfred Newton has expressed himself in the following words in reference to Garrod's labors upon the group of birds now under consideration, and as his views are quite in accord with my own in the premises, his remarks are here fully quoted; he says, "The principal points to which he attended were the arrangement of the carotid artery, and the presence or absence of an ambiens muscle, an oil-gland, and a furcula; but except as regards the last character he unfortunately almost wholly neglected the rest of the skeleton, looking upon such osteological features as the formation of an orbital ring and peculiarities of the atlas as 'of minor importance'—an estimate to which nearly every anatomist will demur; for, though undoubtedly the characters afforded by blood-vessels and muscles are useful in default of osteological characters, it is obvious that these last, drawn from the very framework of any vertebrate's structure, cannot be inferior in

[3] Parker, W. K., and Bettany, G. T. The Morphology of the Skull. London, 1877, p. 264.

[4] Garrod, Alfred Henry. On some Points in the Anatomy of the Parrots which bear on the Classification of the Suborder. P. Z. S., London, 1874, pp. 586–598. See also his Collected Scientific Papers, London, 1881, pp. 247–263, Plates VI and VII. It would be as well to add here that Prof. Garrod's successor, Mr. Forbes, had very little to say about the anatomy of the Psittaci.

value to the former. Indeed the investigations of Prof. A Milne-Edwards (Ann. Sc. Nat. Zoologie, ser. S, vi, pp. 81–111; viii, pp. 145–156) on the bones of the head in various psittacine forms make it clear that these alone present features of much significance, and if his investigations had not been carried on for á special object, but had been extended to other parts of the skeleton, there is little doubt that they would have removed some of the greatest difficulties."

"The one osteological character to which Garrod trusted, namely, the condition of the furcula, cannot be said to contribute much towards a safe basis of classification. That it is wholly absent in some genera of Parrots had long been known, but its imperfect ossification, it appears, is not attended in some cases by any diminution of volant powers, which tends to show that it is an unimportant character, an inference confirmed by the fact that it is found wanting in genera placed geographically so far apart that the loss must have had in some of them an independent origin. Summarily expressed, Garrod's scheme was to divide the Parrots into two Families, *Palæornithidæ* and *Psittacidæ*, assigning to the former three Subfamilies, *Palæornithinæ*, *Cacatuinæ*, and *Stringopinæ*, and to the latter four, *Arinæ*, *Pyrrhurinæ*, *Platycercinæ*, and *Chrysotinæ*. That each of these sections, except the *Cacatuinæ*, is artificial any regard to osteology would show, and it would be useless here to further criticise his method, except to say that its greatest merit is that, as before mentioned (See *Encycl. Brit.*, Art. "Love-Bird," vol. XV, p. 28), he gave sufficient reasons for distinguishing between the genera *Agapornis* and *Psittacula*."

In the same place Prof. Newton further adds, that "Still more recently we have the arrangement followed by Mr. Sclater in the *List* of those exhibited of late years in the gardens of the Zoölogical Society, and published in 1883. This is more in accordance with the views that the present writer is inclined to hold, and these views may here, though with much diffidence, be stated. First there is *Strigops*, which must stand alone, unless *Geopsittacus* and *Pezoporus* may have to be placed with it in a Family *Strigopidæ*."

"Next *Nestor*, from its osteological peculiarities, seems to form a very separate type, and represents a second Family *Nestoridæ*. These two families being removed, all the Parrots that remain will be found to have a great resemblance among themselves, and perhaps it is impossible justifiably to establish any more families. For the present at

any rate it would seem advisable to keep them in a single Family *Psittacidæ*, but there can be no objection to separating them into several subfamilies. The Cockatoos, for instance, can be without much difficulty defined, and may stand as *Cacatuinæ*, and then the brush-tongued Lories as *Loriinæ*, after which the Macaws, *Arinæ*—including possibly *Conurus* and its allies."

"*Platycercus* and its neighbors may form another section, and the same with the *Palæornis;* but for the rest there is not yet material for arriving at any determination, though *Chrysotis* and *Psittacus* seem to furnish two different types, to the former of which *Psittacula* appears to bear much the same relation as *Agapornis* does to the latter. Amongst the genera *Chrysotis*, *Palæornis*, and *Psittacus* are probably to be found the most highly organized forms, and it is these birds in which the faculty of so-called 'speech' reaches its maximum development. But too much importance must not be assigned to that fact; since, while *Psittacus erithacus*—the well-known Grey Parrot with a red tail—is the most accomplished spokesman of the whole group, it is fairly approached by some species of *Chrysotis*—usually styled Amazons—and yet its congener *P. timneh* is not known to be at all loquacious."[5]

With respect to the relation of the *Psittaci* to the Raptorial Birds, Professor Newton has said, "That the *Striges* stand quite independently of the *Accipitres* as above limited can hardly be doubted, and, while the *Psittaci* or Parrots would on some grounds appear to be the nearest allies of the *Accipitres*, the nearest relations of the Owls must be looked for in the multifarious group *Picariæ*" (*loc. cit.*, Art. "Ornithology," p. 47).

In his invaluable and recent work "A Hand-List of the Genera and Species of Birds," Doctor R. Bowdler considers all the members of this group as forming an Order (XXVIII) — the PSITTACIFORMES — which he places between the STRIGIFORMES (Order XXVI [XXVII?]) and the CORACIIFORMES (Order XXIX), the latter starting in with the family *Steatornithidæ* without giving the actual number of the known species of this great host of birds as enumerated by this distinguished ornithologist. I would suppose that his scheme of classification for them is as follows:

[5] Newton, Alfred. Art. "Parrot," *Encycl. Brit.*, 9th ed., Vol. XVIII, p. 323 (1885).

Order.	Families.	Subfamilies.	No. of Genera.
Psittaformes. (XXVIII.)	1. Nestoridæ.		One.
	2. Loriidæ.		Fourteen.
	3. Cyclopsittacidæ		Two.
	4. Cacatuidæ.	1. Cacatuinæ	Six.
		2. Calopsittacus	One.
	5. Psittacidæ.	1. Nasiterninæ.	One.
		2. Counrinæ.	Sixteen.
		3. Pioninæ	Ten.
		4. Psittacinæ.	Three
		5. Palæornithinæ.	Seventeen.
		6. Platycercinæ.	Eleven.
	6. Stringopidæ.		One.

One more authority, and we proceed to set forth the osteological characters of *Conurus carolinensis*. Disregarding all other authors both early and late, and there are many of them, who have given to morphology no weight at all in their classifications, we must take into consideration the opinion of Fürbringer, as we have on so many previous occasions.

This authority arrays the Parrots as quite an isolated group in one of his intermediate suborders (Im. So.: Intermediäre Subordo), and of them he says: "Die artenreiche und in den Tropen weitverbreitete Familie der *Psittacidæ* (p. 1285 f.) repraesentirt eine ziemlich hoch differenzirte und bei allem Artenreichthum enggeschlossene Abtheilung, die das Entwickelungsnivean der mittelhohen Baumvögel erreicht. Ihr morphologisches Verhalten und ihre Abgeschlossenheit allen anderen Vögeln gegenüber zeugt von hohem Alter, wenn auch die bisherige, noch ganz ungenügende palaeontologische Kenntniss dafür kein directes Beweisstück ad oculos demonstrirte. Die Psittacidæ bilden zugleich die einzigen Vertreter der G. PSITTACI und S. O. PSITTACIFORMES; diese Unterordnung dürft aber wohl zwischen den Columbiformes, Galliformes und Coracornithes stehen, wobei sie vielleicht von den Erstge nannten am wenigsten entfernt ist. Die vereinzelten Ähnlichkeiten mit den Accipitres, welche manche Autoren veranlassten, nähere genealogische Beziehungen zu diesen anzunehmen möchte ich in der Hauptsache als Isomorphien beurtheilen. Übrigens wird es noch langer und mühevoller Arbeit und glücklicher Funde bedürfen, bis wir volle Sicherheit hinsichtlich der genaueren genealogischen Stellung der Psittaci erhalten." [6]

[6] Fürbringer, Max, "Untersuchungen zur Morphologie und Systematik der Vögel, etc." Amsterdam, 1888, p. 1552. The several plates illustrating this work may again be profitably examined in connection with the present Suborder, and it will be observed how thoroughly this author separates the Parrots from the *Accipitres*. It is upon this point that I differ with Professor Newton, and I am quite skeptical, as yet, as to there being any near affinity between the Diurnal Raptores and the *Psittaci*.—R. W. S.

THE CHARACTERS PRESENTED BY THE SKELETON IN CONURUS CAROLINENSIS.

From cranio-facial hinge to tip of beak the culmen of the superior mandible of the skull is much, though uniformly, arched. Posterior to the subcircular osseous nares this culminal surface is broad and nearly flat, but beyond these apertures it is convex, both transversely, and as has been said, along its middle line.

The dentary margins of this mandible are cultrate and deeply notched at their middle points, as shown in plate I, Fig 1, where the skull is shown upon right lateral view.

Complete fusion of the nasals, with the bones that surround them has taken place, and all the sutural traces have been absorbed.

The under side of this mandible is bounded behind by a straight, transverse line, above which the palatines are inserted. Its general surface, otherwise, is unbroken, and evenly concave throughout, save a faint medio-longitudinal ridge, best marked behind.

The interior of this superior mandible is, apart from the narial chambers, more or less filled up with an osseous, spongy tissue, that presents a more compact nature where it forms the anterior wall of these latter. This tissue has so far fused with the similar bony mass that represents the maxillo-palatines on either side, that one cannot with certainty judge of their exact limits or boundaries in this species of parrot. This condition also obtains in *Ara* and in *Cacatua* (see Figs. 1 and 3, Plate I).

Speaking in general terms, Professor Huxley says of the *Psittaci* that "the maxillo-palatines are very large and spongy in texture, and unite with one another and the ossified nasal septum so as to fill up almost the whole base of the beak. Above, however, a nasal passage is left on each side; and, below the maxillo-palatines stop short, so that, in the dry skull, a passage, leading into the cavity of the rostrum, is left on each side of the septum." [7]

These remarks are illustrated by the under view of the skull of *Cacatua galerita*, which bird, I think, from the drawing, must have its nasal septum, as well as the spongy mass which surrounds, produced a little further backwards than it is in the subject we have in hand and which is really the case in that species. However, the parts are homologous in both of these forms, though one would hardly have suspected the mass in question to have represented a part of the skull deserving of a special name, had the Carolina parrot been the only bird examined.

[7] Huxley, T. H., "On the Classification of Birds," P. Z. S., 1867, p. 442.

Among the points that have always attracted the most attention in the skeleton of the *Psittaci*, the cranio-facial hinge is here in *Conurus* as perfect in its mechanism as we perhaps will find it in any of the suborder.

Its structure is too well known to enter upon its details here ; I find, however, that neither in this parrot nor any other of the group that I have ever examined is this feature one whit better developed than it is in *Sula bassana*.

Passing now to other parts, we find the union between the sphenotic process and the descending portion of the lacrymal bone to be complete, forming an external orbital periphery or ring, which is very nearly circular (Plate I, Fig. 1). According to Parker, as I have already said, this is brought about through the intervention of the *os uncinatum*, which in some parrots, by union with the zygomatic process of the squamosal, bridges over the temporal fossa.

The lacrymal itself has indistinguishably, so far as a suture is concerned, merged above with the frontal bone, while its union with the sphenotic process, just alluded to, is equally well obliterated. Internally it unites in a similar manner with the small *pars plana*, a circular foramen for the olfactory nerve passing between it and the ethmoid, while externally the antero-inferior arc of the orbital ring is marked by a longitudinal concave notch.

As for the orbital cavity itself, its walls are but fairly entire, the *pars plana* being small, and the exit from the brain-case for the first nerve being far larger than this branch demands. Moreover, the palatines being vertical plates in this situation, and the pterygoids slender, the floor of the cavity is necessarily badly provided for in this regard.

In both these specimens the foramina for the exit of the optic and the third, fourth, and sixth nerves are distinct, and scarcely any greater in size than the structures they are designed to transmit are in calibre.

The interorbital septum is without vacuities, and merges directly throughout with the rostrum of the sphenoid beneath it, the lower margin of the whole plate being sharp, both inferiorly and in front.

Anteriorly the ethmoid bone proper is very broad, being spread out as an abutment against, and bordering for all its width, the posterior line of the cranio-facial hinge. The body of the bone is thickened and filled in with diploic tissue.

That portion of the skull which lies behind and below the orbital ring presents for examination, above, the lateral aspect of the evenly-

convex vault of the cranium, and below, the long squamosal process separated from the sphenotic by a well-defined valley.

The bony ear conch is circumscribed by rounded margins, while to its under side a sharp vertical plate is thrown down, the inferior rim of which is the continuation of the occipital ridge behind, as in *Ara* and *Cacatua*.

As is well known, the characteristic feature of a parrot's quadrate bone is, that its mandibular facet is single, and placed in such a way that its long axis is in the same straight line with the longitudinal axis of the pterygoid; to the possession of this narrow, convex, and long facet *Conurus* forms no exception. Above it, the body of the quadrate is flattened from side to side, with a conical projection on its outer aspect, posterior to its middle point, that has a pit at its apex to accommodate the apophysis on the inner side of the hinder extremity of the quadrate-jugal.

The orbital process of the quadrate is spiculiform and but moderately developed, while the mastoidal limb of the bone rises as a stout subcylindrical rod, with two convex articular facets at its summit. These are divided by a notch, and the inner one of the two is very small, not presenting more than one-tenth of the amount of articular surface the outer one does. The pneumatic foramen is found near its most usual place, on the inner and back part of the mastoidal shaft.

Viewing the skull now from above we observe that the narial apertures can also be seen upon this aspect surrounded above by a few minute vascular foramina, the former being comparatively unusually large in *Cacatua*.

The cranio-facial hinge bordering the superior mandible behind, is found to be a transverse and depressed line extending all the way across.

Between the superior orbital peripheries the frontal region of the skull is smooth and nearly flat; as we proceed backwards it gradually becomes convex, to form the beautiful rounded vault of the cranium. This flatness of the frontal region is very characteristic of the skull of *Ara militarius*.

A few perforating foramina are found just within the two edges of the orbits in the frontal bones, being situated posteriorly and above in the Cockatoos and Macaws.

Turning to the under side of the skull the most remarkable feature that confronts us is the extraordinarily fashioned palatines. These

bones, as they occur in the *Psittaci*, have been described by a number of anatomists, so their peculiar conformation is well known. *Conurus*, as in most true Parrots, has both of these bones horizontally flattened in front, where they are inserted above the hinder portion of the superior mandible to meet the lower part of the nasal septum, but not the palatine of the opposite side.

Proceeding backwards from this horizontal extremity, the palatine is seen to contract, then immediately afterwards to form a broad, oblong and vertical plate. This plate has a certain limited portion of its antero-superior part curled towards the median line, where it meets a corresponding edge of the fellow of the opposite side; and the two here form, by the assistance of the palato-pterygoidal articulation, the usual longitudinal groove for the under edge of the rostrum.

Behind this, the superior margin of the palatine plate is sharp; the posterior margin shows a deep notch, while the inferior margin of the part of the bone is rounded, becoming in front continuous with the dilated anterior end.

Both the internal and external surfaces of these palatine plates may develop processes and ridges for the better insertion of muscles, which in life are thereto attached. A broad, spindle-shaped vacuity exists between these palatines in front, while posteriorly the angle separating their plates is somewhat less than the angle of divergence of the pterygoid bones.

These latter elements are long, nearly straight and cylindrical rods. They are at some distance below the basis cranii, and in no Parrot, so far as is at present known, do they develop basipterygoid processes. Anteriorly, their heads are but slightly enlarged to articulate with each other; with the lower rim of the rostrum; and with the palatines.

The maxillary portion of either of the infraorbital bars is inserted by a somewhat horizontally flattened end, just within the posterior edge of the beak, on a higher plane than the insertion of the palatines, and at a point where I take the foot of the nasal to be. The remainder of the bar almost immediately becomes of a uniform calibre, and at first being concave outwards, passes just beneath the orbital ring, directly downwards and backwards to its articulation with the quadrate.

At the cranial base we find a basitemporal area of small extent, triangular in outline, bounded on all its sides by raised lines, and having its apex directed anteriorly, terminating at the point where occurs the naked and external double-tubed entrance of the Eustachian canals.

On either side of these apertures are seen from three to four, or sometimes only two, minute foramina. Well to the outer sides of there are the conspicuous foramina ovalia.

As has already been said in a former paragraph, the temporal wings of the exoccipital are very prominently produced; and, as usual to their inner sides, at the basal angles of the basitemporal triangle are found the ordinary group of foramina for the entrance and exit of vessels and nerves.

The foramen magnum is of a subcircular outline, and the plane of its periphery makes an angle of some 20° with the backwardly-produced plane of the basis cranii. The condyle is comparatively large, hemispherical in form, and sessile. In *Ara* the foramen magnum is inclined to be cordate in outline.

Rising almost perpendicular to the basitemporal triangle, the occipital area is well defined by an elliptical bounding arc, which sweeps round on either hand to the apices of the temporal wings. In the middle of this space a moderately prominent, unpierced, supraoccipital elevation is to be seen. In removing the cranial vault I find that the tables are very closely juxta-opposed, and, in consequence, but a little diploic tissue present. The several cerebral fossæ are sharply defined by out-jutting lamelliform ledges of bone.

At the base of the sella turcica there seems to be a common carotid opening, and the posterior clinoid wall of this fossa is very thin, and usually exhibits one or two perforations.

The *mandible* (Plate I, Fig. 1) of *Conurus* is somewhat horseshoe-shaped, with very deep and smooth ramal sides, which are deficient anteriorly, leaving a semicircular opening with cutting edge all around. When the horny mandibular sheath is carefully removed in the fresh specimen, this edge has filiform prolongations of soft tissue standing out from its middle third below, which after they have dried and become more or less shrunken, look something like a row of delicate teeth.

The ramal sides of this bone slope away as we proceed backwards, and the mandibular ends are truncated at about the same angle.

To the inner sides of these articular ends a ledge is thrown out to support the facet for either quadrate. Behind these longitudinal articular grooves, single pits are found, at the base of which the pneumatic foramina occur.

The under borders of the mandible are smooth and rounded. The mandibles are very powerfully constructed in the Macaws and Cockatoos (See Figs. 3 and 4).

Of the Hyoid Arches.—Notwithstanding the fact that the glossohyal which supports the thick, short and fleshy tongue of this Parrot remains in cartilage throughout life, the ceratohyals are very completely developed. They meet in the median line, and ossify up to the very hinder body of this element and anterior to them. Where they unite at the mesial point behind, an articular surface is formed for the first basibranchial. This last named element is unusually long, and anchyloses with the second basibranchial, the point of mergence being enlarged to accommodate the heads of ceratobranchials and anteriorly to support a peculiar osseous outgrowth that, so far I am at present informed, is restricted to the *Psittaci;* indeed, this is the only form in which I have observed this latter feature.

The ceratobranchials are very long, subcylindrical and rather stout rods of bone, while, on the other hand, the epibranchials are notably short and but feebly developed. As thus constituted, the thyrohyal elements show but little curvature along their continuities, and still less disposition to curl up behind the cranium.

Of the Remainder of the Axial Skeleton.—*Conurus carolinensis* has thirty-five vertebræ in its spinal column, and a large pygostyle at its terminal extremity. This agrees with *Cacatua galerita.* (See Pl. III.) The *atlas* is characterized by a broad neural arch above, a perforated cup for the occipital condyle, and a prominent process extending backwards from the pseudo-centrum behind.

Axis vertebra has a very inconspicuous odontoid process, strongly developed neural and hypapophysial spines, and tuberous postzygapophyses. This segment, like the rest of the column and the pelvis, is pneumatic; to this statement, however, the last five caudal vertebræ and pygostyle prove an exception.

Both third and fourth vertebræ have strong hypapophysial spines, and neural ones scarcely less marked. In these, too, the lateral canals are seen, but the processes at their hinder margins are, as yet, but feebly produced. The zygapophysial arms are short, and their being joined from before backwards in each case by bone extension lend to these two segments a width upon their dorsal aspects and a solid appearance not possessed by any of the other vertebræ posterior to them.

In the fifth vertebra, the dorsal and ventral spines have lost not a little of their prominence, while the parapophyses are much longer. This segment has the postzygapophyses manifestly lengthened, whereas but little change has taken place in the anterior pair.

The sixth vertebra loses the neural and hypapophysial spines altogether; the parapophyses gradually diminish in size from this segment down the chain, until they, with the pleurapophyses, again become prominent as free ribs. Likewise the neural and lateral canals, which are here quite small, also increase in calibre as we proceed in the same direction. This vertebra has also a short carotid canal present in place of the hypapophysis. And this last feature is still better marked in the seventh vertebra, though it remains open below. These are the only two which have it in this parrot, in the eighth its site being again occupied by a low, median, hypapophysial spine.

In all these segments, as well as in the few succeeding ones that we find before coming to the true dorsals, the pre- and postzygapophyses are diverging limbs of the most usual form in *Aves*. The articulation among the centra is heterocœlous.

The ninth vertebra has the neural spine commencing to make its appearance again, and is here a low tubercle, more prominent in the tenth, and thus on till it assumes the dorsal form of this spine. The hypapophysial plates in both the ninth and tenth vertebræ are deep, long, and of a quadrate form, and from the lateral masses being low on the sides of the centra, they appear sunken between these protuberances.

We find that the twelfth vertebra has much the general aspect of one of the dorsals, and, moreover, its pleurapophyses have become freed as a tiny pair of ribs. These attain quite a respectable length in the thirteenth vertebræ, while in the fourteenth, where they are still unconnected with the sternum, they possess small unciform processes. This practically agrees with what we find in *Cacatua*. (Pl. II, Fig. 8.)

We may term the fifteenth to the eighteenth vertebræ inclusive true dorsals, for they all have ribs connecting them in the usual way with the sternum. They also have interlocking neural spines, and their transverse processes are strengthened by each one developing a single spiculiform interlacing metapophysis at its outer extremity. Prominent hypapophyses are found upon the thirteenth, fourteenth, fifteenth, and sixteenth, and a small one sometimes on the seventeenth vertebra.

The ribs have broad unciform processes anchylosed to them, but there are still two other pairs that come from beneath the pelvis, belonging as they do to the sacrum, that also meet costal ribs below, which do not have these appendages.

Sometimes abortive ribs are found anchylosed to the twenty-first and

twenty-second vertebræ, these being the third and fourth segments appropriated by the sacrum.

Now, in my male specimen of the paroquet, I find that the nineteenth to the twenty-ninth vertebræ, inclusive, form the pelvic sacrum, while in the female an additional segment, which in the male remains a free caudal, has become firmly attached behind.

This circumstance gives the male six free tail vertebræ, whereas the other specimen has but five. Such a condition as this, however, not unfrequently happens among birds, where the count for the entire number of vertebræ in the column remains wonderfully constant for the species.

The caudal vertebræ (Pl. I, Fig. 2) have spreading transverse processes, and stumpy neural spines; the ultimate two having strong bifid hypapophyses.

Of an irregular quadrilateral outline, the pygostyle has thickened hinder and lower margins, while the remaining two are cultrate.

Giving our attention now to the *pelvis*, we find this compound bone in *Conurus* (Pl. I, Fig. 2) devoid of any very striking features, it having all the general characteristics of this part of the avian skeleton, lacking anything to particularly distinguish it from the form the bone usually assumes among most ordinary birds.

Viewed from above, it will be seen that the pre- and postacetabular areas are about equal in extent, the ilium being concave where it forms the first, and the reverse where it constitutes the latter. For the entire length of the sacrum these bones are firmly sealed to its outer margins, forming the most complete "ilio-neural canals" anteriorly, which do not even open posteriorly as in some birds; while behind it lends to the postacetabular area a very unbroken aspect, that is rendered even more so from the absence of all but a few small foramina among the sacral diapophyses.

Upon the lateral aspect of the pelvis we note that the propubis is not developed, and that the inner periphery of the cotyloid ring is nearly as large as the outer one. The small obturator foramen is rendered complete by a pretty thorough meeting between the ischium and the somewhat slender postpubis immediately behind it.

The obturator space is long and spindle-shaped, but the lower angle of the ischium does not meet the postpubic shaft beneath it, as it does in so many birds.

The antitrochanter and the elliptical ischial foramen are both of comparatively moderate size.

On the under side we find that the lateral processes of the leading four sacral vertebræ are thrown out as abutments against the nether sides of the ilia; beyond, or rather behind these, the usual cavity of the pelvic basin occurs, and the succeeding diapophyses of these consolidated vertebræ are less manifest than common, being all elevated and having their extremities in the roof above.

The foramina for the exit of the sacral nerves are double, in each case one being placed above another, and the swell to accommodate the myelonic enlargement in this part of the cord's track is here well pronounced.

Conurus, in common with many other parrots, has for its general size comparatively a large *sternum* (Plate I, Fig. 2). Seen from above we observe that the costal processes are but scarcely produced above the lateral borders, which latter rise gradually to their summits. These costal borders each support six facets for the hæmapophyses, the concavities among them being pierced by small groups of pneumatic foramina.

The space occupied by one of these costal borders is equal to about half the whole length of the lateral sternal margin. (Compare the sterna of *Cacatua* and *Calyptorhynchus* shown in Plate III, Fig. 8 and Plate II, Fig. 5.)

Posterior to them, on either side, the margins are sharp all the way round the xiphoidal extremity, this part of the bone having a shield-shaped outline, being concave above, though not nearly so much so as that part of the sternal body lying between the costal borders in front.

In this latter section we sometimes find a few scattered pneumatic foramina down the median line; the most constant, and a large one of these, however, is close up to the anterior border of the bone, which curls backwards over it, and the fossa thus formed is always spanned over by a median longitudinal bridge of bone.

The anterior sternal body is thickened, and directly over its sharpened edge in front we find a continuous coracoidal groove; beyond this there rears up directly a broad quadrate manubrium, which is continuous with, and has its lateral surfaces in the same plane with, the carina below.

Extending the entire length of the body of the bone the keel of this sternum is comparatively a very deep one. Both its lower and anterior borders are convex, the latter being quite sharp. The carinal angle formed by the meeting of these edges is rounded off, so that the lines form really one common curved line (Fig. 2).

That anterior vertical and thickened column of bone which is present in the keel of nearly all avian sterna is here well developed, but situated at some little distance back from the anterior margin. Moreover, it does not descend so far as is usually seen, being apparently interrupted by the muscular line which longitudinally marks the bone.

The muscular lines of the pectoral aspect are roughly parallel to the costal borders, and remain quite distinct as we proceed towards the xiphoidal extremity, nearly as far as the elliptical fenestra that there occur, one on either side.

In the *shoulder-girdle* (Fig. 2) we find a *scapula* with rather a short blade through a stout one, having the usual sabre-like form with obliquely truncated extremity posteriorly.

It contributes the usual amount of articular surface to the glenoid cavity, but when *in situ* does not occupy the entire length of the superior line of the scapular process of the coracoid, nor have any connection with the furculum except through a slight ligamentous attachment.

It will be observed that in *Conurus* the coracoid has a form that partakes much of the pattern it assumes among birds generally. (See Figs. 2, 5, and 8 of the plates.)

Its tuberous summit is inclined slightly forwards and towards the median line, when articulated *in situ*, and has resting against it the frail clavicular head of that side. The scapular process already alluded to is well developed, but here chiefly given over to quite extensive ligamentous attachment.

The coracoidal shaft is strong, comparatively of good length, and subcompressed in the antero-posterior direction, being faintly marked at the usual sites by muscular lines.

At the sternal extremity of the bone we find the expanded portion, the form of which can best be seen in Fig. 2, where we note that the lateral process at its externo-inferior angle is well marked.

Many parrots are notorious for having incomplete furcula, as in *Calyptorhynchus*. (See Pl. II, Fig. 5). In others the union at their medio-inferior points is very feeble.

In this particular they resemble some of *Strigidæ*. Our Carolina paroquet has a complete *os furculum;* it is, however, a very weak bone, and functionally accomplishes little more than an ossified ligament in the same position. Indeed, it reminds one very much of such a structure, for when duly articulated it is but little in advance of the imaginary plane that is tangent to the anterior surfaces of the coracoidal

shafts, and consequently but little dissociated from the ligaments that descend from the coracoidal summits to meet for attachment on the top of the sternal manubrium. It is in form of the U-shaped pattern, and without a hypocleidium at the clavicular junction below.

As already intimated above, and so far as the light I have on the subject will at present permit me to judge, I believe that the shoulder-girdle of *Conurus* more nearly resembles these parts in some of the owls than it does the corresponding lines in any other class of birds with which I am acquainted.

Of the Appendicular Skeleton.—The pectoral limb of this parrot presents no very striking deviations from the average skeleton of the wing as found in existing birds.

The bones are all harmoniously balanced both as regards their relative lengths and calibres.

Pneumaticity is enjoyed by the *humerus* alone, as in *Cacatua*, and this bone is here characterized by a short, though not inconspicuous, radial crest, an ulnar crest devoted, as usual, to forming a canopy over the pneumatic fossa, in which are found the air-holes leading to the interior of the humeral shaft. This latter is but little curved in any direction, being subcylindrical and smooth. At the distal extremity of the bone we find the trochleæ for articulation with the antibrachial elements prominently produced, while on the obverse aspect a broad and a narrow gutter is seen, which guide the passing tendons in life.

The *radius* is nearly straight for its entire length, differing from the *ulna* in this particular, it having a considerable curve along its shaft, the concavity of which is on the radial side, and gives rise to quite a wide interosseous space.

The carpal elements are two in number as usual, and they have the form most commonly presented by these bones throughout the majority of the Class.

In the manus we find a carpo-metacarpus of the ordinary form for birds generally. Its rather large pollex phalanx is without a claw, this feature being likewise absent from the tips of the distal digit.

None of the bones of the pelvic extremity in *Conurus* have air admitted to their interiors, and they all become dark and greasy in the ordinarily prepared skeleton. This is likewise the case in *Cacatua* and other *Psittaci*.

The *femur* has a large, semiglobular head, with a shallow, though

quite extensive excavation upon it, for the round ligament. A broad articular surface is found at the summit of the bone for the anti-trochanter of the pelvis, and the suppressed trochanterian ridge does not rise above this.

The shaft of the bone is but little bent in any direction, and it has the usual cylindrical form. At the distal extremity the condyles are fairly well developed, not strikingly large, the outer one being the lower when the bone is held in the vertical position. In front the rotular channel does not extend upon the shaft above them, while behind the popliteal depression is shallow also.

The cleft for the fibular head marks the posterior aspect of the external condyle, dividing it, as usual, into two parts.

Our subject possesses a small *patella* of a subcordate form, maintaining its usual relations with the bones of the leg and thigh.

The *tibio-tarsus* has its cnemial crest but very slightly produced above the articulating surface at the summit of the bone, while below it the pro- and ectocnemial ridges are but feebly manifested, and very soon merge into the shaft. This latter is quite straight and smooth, being slightly compressed in the antero-posterior direction. At the distal extremity the inner condylar protuberance is decidedly the more promiminent, both upon the front and rear aspects. The valley between these two eminences is quite wide and well defined, even to the posterior side of the bone.

The osseous bridge for the extensor tendons is present.

Marked feebleness in development is displayed on the part of the *fibula* of the Carolina Parrot, for this bone is found not to extend below the ridge it articulates with on the side of the shaft of the tibiotarsus. Below this point the inferior apex of the fibular shaft is produced and replaced by a ligament of hair-like dimensions. In Cockatoos, too, the fibula is a very short bone. What there is of the bone in *Conurus*, however, is fully as well developed as we usually find it in the class; simply its apparently useless prolongation, as seen in many birds, has never ossified.

In the skeleton of the foot we find a short thick-set tarsometatarsus, with spreading trochlear extremity. Its shaft is short and straight, being much compressed from before backwards. On the anterior aspect it is convex from side to side, while behind it is longitudinally excavated. The hypotarsus is a narrow, projecting ledge with one vertical, cylindrical perforation near its center, and scarcely grooved

for the other tendons behind. At the summit of this bone we note the two condylar depressions for the trochleæ of the tibio-tarsus.

The usual arterial foramen pierces the shaft at its ordinary site at the distal end.

As is well known, *Psittaci* are permanently zygodactyle birds by reversion of the fourth toe, while they not only possess a well developed and free accessory metatarsal, but the usual number of joints to the digits. *Conurus carolinensis* agrees in all these particulars.

Whenever I can I make it a rule to fully illustrate in the figures the tibio-tarsus and skeleton of the pes, as the points presented by these parts stand among the most important in this all-important system of the bird's anatomy, for when sufficient data of this kind become available they will be not only valuable as an aid in classification, but help to determine the affinities of existing birds with such fossil forms as may from time to time be discovered. It will be seen that I have not overlooked this fact in the plates to my original memoir on the osteology of *Conurus*, published in the Journal of Anatomy of London.

SYNOPSIS OF THE SKELETAL CHARACTERS OF CONURUS CAROLINENSIS.

1. Superior mandible arched as in Raptores; osseous nares small, subcircular, separated by nasal septum. Dentary margins of mandible cultrate and notched.

2. Orbital ring complete.

3. Cranio-facial hinge as in other *Psittaci*.

4. Lower margin of rostrum cultrate.

5. Quadrate has a large and small facet on mastoidal head, a rather small orbital process, and a single, longitudinal mandibular facet, which is laterally compressed and convex in both directions.

6. Pterygoids long and slender rods, anteriorly articulating with each other and with the palatines.

7. Major portion of either palatine—a large vertical plate, directed downwards and backwards. These bones curl toward each other and form a limited articulation in the median line; anteriorly they are horizontally flattened, and are hinged to the mandible beneath the spongy mass, which constitutes the maxillo-palatine and nasal septum.

8. Mandible truncated in front; rami and symphysis deep and gradually rounding into each other.

9. Hyoid apparatus with large, united ceratohyals, and a peculiar bony outgrowth on either side of the first basibranchial, extending forwards.

10. Manubrium of sternum erect, large, and continuous with the deep carina. The xiphoidal extremity of this bone has an elliptical fenestra on either side. Costal processes low, and usually six hæmapophysial facets on each costal border. Coracoidal grooves unite in front.

11. Furculum of shoulder girdle firmly united below.

12. The humerus only is pneumatic in the pectoral limb.

13. A well-developed patella present. Fibula short, extending only so far as the lower end of fibular ridge of tibio-tarsus.

14. The tendinal bridge at antero-distal end of tibio-tarsus at right angles to long axis of shaft. The inner condyle the larger and more elevated.

15. General skeletal characters of pes agree with other *Psittaci*.

Negative Characters.

1. Vomer absent.

2. Basipterygoid processes not developed.

3. No hypocleidium on os furculum, and this bone does not meet the scapular process of coracoid.

4. Propubis of pelvis absent.

5. Pelvic limb non-pneumatic.

The following osteological characters when associated in the same skeleton characterize a representative of the family PSITTACIDÆ *of the suborder* PSITTACI.

1. Superior osseous mandible of skull with cultrate dentary margins, usually 1-notched on either side; arched as in Raptores. (The notching is absent in *Ara*.)

2. External orbital periphery usually completed in bone.

3. A movable cranio-facial hinge present in the skull.

4. A single mandibular facet on either quadrate.

5. The maxillo-palatines a spongy mass, fusing with the surrounding bones.

6. The rami of the mandible unusually deep, the symphysis truncated anteriorly.

7. Xiphoidal border of sternum rounded, unnotched; and may be pierced by a foramen on either side.

8. Os furculum concaved forwards as well as inwards; usually united, mesially, below, though the reverse may be the case.

9. Fibula markedly short.

10. Tarso-metatarsus short; the fourth toe permanently turned backwards, and articulating with a double facet.

The Avian Affinities of the Psittaci.

Not as yet positively known; most generally suspected of having kinship with the *Raptores*, and by Huxley, with his group the COCCYGOMORPHÆ, as well. Such speculation may be entirely erroneous, however, and after all the nearest kin to the *Psittaci* may be the Owls (*Striges*), a group having no specially close relationship with the *Raptores*.

OBSERVATIONS UPON THE OSTEOLOGY OF THE OWL PARROT.

(*Strigops habroptilus.*)

Various authors have given us brief accounts of the anatomical structure of this very remarkable family of the PSITTACI, but a complete account of its morphology is yet in demand. Several years ago, Professor Fürbringer considered it to be one of the primitive Parrot-forms (Journ. für Orn., 1889, pp. 239–241), and Garrod, Blanchard, and A. Milne-Edwards, have each and all contributed at different times something towards an understanding of its anatomy. Newton in his "Dictionary of Birds" under the article "Kakapo" gives an excellent brief article upon its history, and Sir W. Buller's "Birds of New Zealand," has a very considerable account of the same.

Newton remarks in the Dictionary that there "can be scarcely any doubt as the propriety of considering this genus the type of a separate family of *Psittaci;* but whether it stands alone, or some other forms (*Pezoporus* or *Geopsittacus*,[8] for example; which in coloration and habits present some curious analogies) should be placed with it, must await future determination."

Garrod has said,[9] "As a Parrot it is not so strikingly peculiar as many seem to think. Its wings are useless, and the carina sterni is correspondingly reduced, it is true; but as points of classificational importance, I regard these as insignificant. The points of special anatomical interest which it does possess, however, are particularly instructive.

[8] "Dr. Reichenow (Journ. für Orn., 1881, pp. 13–16) boldly unites them in a single family, but in that case it should bear the name of *Pezoporidæ*."

[9] Coll. Sci. Mem., p. 257.

"The proximal ends of the incomplete furculum are well-developed, so much so that it might at first sight seem that their symphysial ends are only lost in correlation with the excessive reduction of the powers of flight; though this is probably not the case, because the allied similarly modified genera *Euphema*, etc., do not keep to the ground."

Doctor Sclater and Dr. Sharpe have both in their schemes of avian classification placed *Strigops* in a family *Strigopidæ*, and its structural peculiarities certainly entitle it to no higher rank in the system. *Geopsittacus*, externally, closely resembles the Owl Parrot, but I have not as yet had the opportunity to examine the osteology of this genus, and so from personal observations I am unable to say whether it ought to be included in the *Strigopidæ* or not.

Apart from the partial atrophy of the pectoral limb, carina sterni, and possibly the os furculum, I see nothing very extraordinary in the skeleton of this Ground Parrot, as the balance of its osseous structure is completely psittacine, and points in no other direction whatever.

In the *skull* the orbital bony ring is complete, while the orbit, comparatively speaking, is rather small. The nostril is not circular as in *Conurus*, but presents a continuous limited concavity in front of it. For a Parrot the mandibles are lacking in the power so often seen in other members of the group. They are far *straighter*, and the notching at the end of the superior is barely evident.

As in *Conurus*, it has 14 *cervical vertebræ*, with a well-developed pair of free ribs attached to the last two. The *dorsals* include the 15th to 19th vertebræ and all these have ribs connecting with the sternum; and all these ribs have epipleural appendages save the last pair. This also applies to the only pair of *pelvic* ribs present, and these also connect with the sternum by means of their hæmapophyses. One pair of "floating ribs" are also present.

The *pelvis* in all essential respects is psittacine, and the *six* vertebræ of the tail, as well as the *pygostyle*, are well-developed.

While the skeletal frame of the wing is markedly reduced in size, this does not apply to the strong bony skeleton of the pelvic extremity, and both have the usual parrot-characters of these parts distinctly present. In the manus, both the *pollex* and the *index* digit are terminated by a minute, free claw-point, that is not to be found in all members of this suborder.

With this brief reference to the osteology of the famous Owl Parrot, I simply repeat here that I must believe there can no longer be any

question that this interesting form, simply represents a family, and probably a very old family of the psittacine group of birds.

EXPLANATION OF PLATES.

[The figures in Plates XXI–XXIII are all from photographs made by the author direct from the specimens, those of *Conurus* being in his own collection, and the others from specimens belonging to the United States National Museum. The skeleton of the Owl Parrot (*Strigops habroptilus* Gray) was photographed by Professor T. W. Smillie of the U. S. National Museum, and is specimen No. 18,276 of the osteological collections of that institution, it having been obtained at Dusky Sound, N. Zealand, a number of years ago.]

PLATE XXI.

Fig. 1. Right lateral view of the skull and mandible (the latter detached) of *Conurus carolinensis*. Adult ♀; natural size.

Fig. 2. Right lateral view of the trunk skeleton and attached shoulder girdle of *Conurus carolinensis*, adult ♀, natural size. From the same individual, the skull of which is shown in Fig. 1.

Fig. 3. Left lateral view of the skull and mandible of a Macaw (*Ara militarius*). Specimen collected by F. Bischoff at Mazatlan, Mexico.

PLATE XXII.

Fig. 4. Right lateral view of the skull and mandible (the latter detached) of *Cacatua galerita*, adult, nat. size. (Spec. No. 18,744.)

Fig. 5. Ventral aspect of the sternum and shoulder girdle of *Calyptorhynchus banksi*, adult ♀. (From N. S. Wales, Clarence River.)

Fig. 6. Anconal aspect of left humerus of *Cacatua galerita*. From the same individual which furnished the skull shown in Fig. 4, natural size.

Fig. 7. Palmar aspect of right humerus of *Cacatua galerita* from same specimen as Figs. 4 and 6. Nat. size.

PLATE XXIII.

Fig. 8. Right lateral view of the trunk, skeleton, shoulder girdle, and last five (5) cervical vertebræ of *Cacatua galerita*, natural size, and from the skeleton of the same specimen which furnished the skull and humeri shown in Plate II, Figs. 4, 6, and 7.

PLATE XXIV.

Fig. 9. Right lateral view of the skeleton of the Owl Parrot (*S. habroptilus*). Considerably reduced.

XVII. AN ANNOTATED CATALOGUE OF SHELLS OF THE GENUS PARTULA IN THE HARTMAN COLLECTION BELONGING TO THE CARNEGIE MUSEUM.

By Herbert H. Smith.

The conchological collection of the late Dr. William T. Hartman, recently acquired by the Carnegie Museum, contains about 9,000 named species. Its greatest treasure is the magnificent series of the genus *Partula*, probably the richest in the world. This embraces 83 species which Dr. Hartman considered valid, besides some 50 named forms and many unnamed ones, which he regarded as varieties, and about 20 hybrids; the whole represented by 240 suites, and 1,647 specimens, almost invariably in fine condition. Nearly all the types of Dr. Hartman's own description are with the collection; many others from the Pease and Garrett collections are authentic examples; a number were compared with the types in Europe. Of the species described up to the time of Dr. Hartman's death, 21 are unrepresented, but nearly all of these are still known from single examples, or are altogether lost or doubtful.

The specimens, like all the shells in the Hartman collection, are mounted on tablets. Besides the labels on the face of the tablets there are frequently notes, of greater or less importance, on the back; sometimes the original label is pasted to the card; and in a number of instances the shells are accompanied by photographs. There are also several mounted photographs of types etc. which are not now in the collection, some photographic negatives, and nine water-color drawings, by E. A. Smith, of types in the British Museum.

With the collection are several packages of letters from conchologists and collectors in various parts of the world; these often contain notes of great interest. As far as the genus *Partula* is concerned the most important are those from Mr. Andrew Garrett, of Huaheine, Society Islands. Mr. Garrett was an excellent naturalist as well as an enthusiastic collector. During the greater part of his active life he resided in Polynesia, visiting all the principal islands and eventually settling at Huaheine. He published many excellent scientific papers, including three on the shells of the Society, Samoan, and Fiji Islands. His

own conchological collection was especially rich in species from that region; and it is impossible to read his letters without being impressed by his love for accuracy in every detail. Nearly all the Partulas in the Pease collection were collected by Mr. Garrett, and he gave them provisional names which Pease generally adopted. As Mr. Garrett retained labeled sets of most of the Peasean species, his opinion in doubtful cases is of prime importance. This is especially the case since Mr. Pease was rather careless in labeling shells and recording localities. Many of the habitats attributed to Polynesian shells in his catalogue, published in 1871, are erroneous. Mr. Garrett, on the contrary, was rigidly careful in noting localities; he kept a daily journal, and was in the habit of noting the discovery of every fresh species of shell, with the provisional name.

Dr. Hartman's correspondence with Mr. Garrett was carried on during many years, and was singularly open and friendly. They exchanged shells constantly, and often sent specimens to each other for comparison. Though both were publishing papers which, to some extent, dealt with the same subjects, there was no shade of the jealousy which is too common in such cases. Each respected the opinions of the other; each modified his views more or less as he was influenced by the other, until they were almost completely in accord. Up to the time of Garrett's death they had disagreed respecting a number of doubtful species; but it is noteworthy that Dr. Hartman's last (MS.) revision of *Partula* concedes nearly every one of these points. Probably he was right in this; the naturalist who has collected and observed thousands of specimens in the field gains an insight that can be obtained in no other way. Most of the Garrett correspondence was preserved.

Among the Garrett letters there is a MS. catalogue of *Partula*, undated, but apparently written about 1881; this appears so important that it is published at the end of this paper, together with some extracts of general interest from the letters.

Mr. E. L. Layard, British Consul in the New Hebrides, and an enthusiastic conchologist, is the principal authority for localities in that region. Unfortunately the Layard correspondence is incomplete. Many of the letters related in part to the disease (cancer) of which Mr. Layard subsequently died, and for which Dr. Hartman was prescribing; these were destroyed. The remaining letters contain many notes of importance on the New Hebrides Partulas.

Dr. J. E. Cox and Mr. John Brazier, both of Sidney, Australia, are represented by a few letters. Mr. Brazier sent a number of Partulas to Dr. Hartman, as he had earlier to Pease. Unfortunately, his records of localities are not always beyond doubt. Dr. Cox sent the whole of his Partulas to Dr. Hartman for examination, and permitted him to retain some of them. In the correspondence there are two sheets of memoranda on Partula, by Dr. Cox, written about 1882; some of the notes are important. Dr. Cox exchanged shells with Mr. Garrett and Mr. Layard; his earlier correspondence with Dr. Hartman was carried on through Garrett, who forwarded exchanges.

When Dr. Hartman began his special study of Partula, about 1877, the genus was in a condition of almost hopeless confusion. Cuming's species, described by Pfeiffer and others, were assigned to islands often thousands of miles from their true habitats, and in some cases it really seemed as if the errors were intentional. Pease was generally correct in his discrimination of species and varieties, but very careless about localities; many of his MS. names were supposed to indicate valid species, though he had never intended them to be more than provisional or the marks of varieties. Carpenter, who examined a series of the Pease duplicates, referred them to other species, and almost always erroneously. Scores of varieties had been described as species; many species were regarded as varieties; hybrids and decorticated shells were described as species; known species were erroneously recorded from different islands, and described as new by naturalists who regarded the habitat as a sufficient proof of validity. Even reference to type specimens was not always conclusive; in more than one instance the original type had been replaced by a shell of another species.

Dr. Hartman's writings on the genus Partula were published at intervals, from 1881 to 1893, and embrace the following papers:

Description of a Partula, supposed to be new, from the Island of Moorea. Proc. Acad. Nat. Sci., Phila., p. 229, 1880.

A catalogue of the Genus Partula Fér. (printed for private distribution). West Chester, 1881.

Observations on the species of the Genus Partula Fér., with a Bibliographical Catalogue of all the species. Bull. Mus. Comp. Zoöl., IX, No. 5, pp. 171–190, 1882.

Observations on the duplicates of the Genus Partula Fér. contained in the Museum of Comparative Zoölogy, Cambridge, Mass., formerly

belonging to the collection of the late Wm. H. Pease. Bull. Mus. Comp. Zoöl., IX, pp. 91–96, 1882.

Descriptions of New Species of Partula and a Synonymic Catalogue of the genus. Proc. Acad. Nat. Sc. Phila., pp. 203–223, 1885.

New Species of Partula from the New Hebrides and Solomon Islands. Proc. Acad. Nat. Sc. Phila., pp. 30–35, Plate II, 1886.

New Species of Shells from the New Hebrides and Sandwich Islands. Proc. Acad. Nat. Sc. Phila., p. 250, Plate XIII, 1888 (includes several Partulas).

Descriptions of New Species of Shells. Proc. Acad. Nat. Sc. Phila., pp. 284–288, plate III, 1890 (includes a species of Partula).

Catalogue of the Genus Partula, "The Nautilus," vol. VI, pp. 73 and 97, 1892–93.

Through the courtesy of Mr. H. A. Pilsbry, of the Academy of Natural Science, Philadelphia, I have been permitted to examine a MS. work by Dr. Hartman, containing the final results of his studies of Partula, and revised to within a short time of his death. This was originally intended to be a monograph of the genus, but to some extent it is incomplete. In it he corrects errors in his previous writings, reconsiders a number of doubtful species, and gives descriptions of most of the valid ones.

Dr. Hartman visited Europe in 1883 and personally examined a number of types in London and Paris, besides adding largely to his collection. He had free access to type specimens from the Pease collection in the Academy of Natural Science, and the collections, made by the United States Exploring Expedition, in the Smithsonian Institution, as well as the Pease duplicates, which he studied in the Museum of Comparative Zoölogy.

The result of his labors was to bring something like order out of the tangled mass, and for this he deserves the everlasting gratitude of conchologists. But there are still many doubtful points.

The main object of the following catalogue is to smooth the way for future monographers of the genus. I have rigidly abstained from expressing opinions, and have made only a few suggestions. In the case of doubtful species or habitats, scraps of information are often important, and a great number of these have been gleaned from the letters of Mr. Garrett and others. No doubt many of the extracts will be useless; but it was not always possible to judge of their value, and I have thought it better to preserve every extract which seemed to throw the

slightest light on the subject. The labels and the notes on the reverse side of the tablets have been given verbatim; the only liberty I have taken has been in the use of capital letters, and in correcting some trifling orthographical errors. My own notes merely call attention to doubtful points, indicate varieties, explain synonyms and fix, or endeavor to fix, the position of the small islands mentioned.

The arrangement is that of Dr. Hartman's MS. Catalogue, which is of later date than any of his published works. Species not represented in the collection are noted in their proper places; all hybrids are thrown together. The photographs and drawings are catalogued last.

The numbers are those of the Carnegie Museum Conchological Collection. Each species which Dr. Hartman regarded as valid is indicated by leaded type; the varieties and synonyms following it are in italics. Labels and extracts from letters or printed papers are in quotation marks.

In his earlier labels Dr. Hartman often used the word "type" to indicate specimens which agree with the original description or example. In many cases he has changes the word to "typical," but some of the labels have never been corrected. In the case of many shells from the Pease and Garrett collections "type" really means "authentic example." In most instances it would be impossible to identify the original Pease types, and perhaps the Hartman examples have as good a claim as any. I have, however, inserted the word *typical, H. H. S.* in parenthesis after "type," wherever the latter has been used for any shell except the one originally described and figured.

4093. "**Partula faba** Martyn, Raiatea." On the back of the card is written: "Martyn's type with the label of Pease." The name and locality, in Pease's handwriting, are on a slip pasted to the card, and beside it is written: "Pease scrib." By "Martyn's type" must be understood typical examples. Five specimens. Three are pale olive except a narrow band at the suture and a broad one covering the lower part of the body whorl; the others are brown, darker below, one rather broad and the other unusually elongate for this species. One of the banded specimens is the original of the figure published in Dr. Hartman's "Catalogue of the Genus Partula," 1881, and in the "Nautilus," Nov., 1892, p. 74.

4094. "*Partula faba* Martyn, Raiatea." Five specimens, all with the sutural and basal bands, but the paler portions are obscured by oblique strigations.

4095. "*Partula faba* Martyn, Raiatea." Seven specimens, pale with oblique dark lines, and without the bands.

4096. "*Partula faba* Martyn, Raiatea." Ten specimens of a pale olive colored variety; two of these are darker around the umbilicus, one showing also the sutural band. In color they approach No. 4106 (var. *P. pallida* Pse. MS.), but the shell and aperture are broader.

4097. "*Partula faba* Martyn (variety), Raiatea, Coll. Pse." Eleven specimens, dark chestnut brown to olive brown, without bands and varying much in form and size.

4098. "*Partula faba* Martyn (abnormal), Raiatea." Seven more or less dwarfed and unsymmetrical examples.

4099. "*Partula subangulata* Pse. MS., Tahaa, Coll. Pse." Nine specimens. Six are castaneous to brown (one with an obscure darker band); one (somewhat immature) is pale with a broad dark band; two are albinos. This is *P. faba* var. *subangulata* Pse., Jour. de Conch., 1870, p. 401, and Proc. Zoöl. Soc., 1871, pp. 458, 473, Pl. 3, Fig. 79. Hartman, Proc. Acad. Nat. Sc. Phil., 1885, p. 206, etc. The banded example corresponds almost exactly to some of the specimens of the var. *P. amanda* Garr., No. 4101, also (according to Garrett) from Tahaa.

4100. "*Partula subangulata* Pse. MS., Raiatea, Coll. Smithsonian." Nine specimens. One is dark castaneous with a narrow pale sutural band; four are brown with more or less obvious oblique strigations; four are pale olive colored. Pease, Proc. Zoöl. Soc., 1871, p. 458, says that Raiatea is the metropolis of *P. faba* and that the var. *subangulata* is found (exclusively?) in Tahaa. Garrett, in his MS. Catalogue, gives the habitat as Tahaa.

4101. "*Partula amanda* Garr. MS., =*faba* var., Raiatea, ex auctore." On the back of the card is written: "This shell in A. N. S." (Academy of Natural Science, Philadelphia) "is labeled '*P. bella* ex auctore.'" Eleven specimens. The ground color varies from castaneous to pale olive brown and there is a broad encircling band, or two narrow bands, sometimes obscure, or a broad band with darker edges. One (smaller) example is almost wholly dark, with a narrow pale band at the suture, corresponding to the var. *marginata*, No. 4107. Another has a well developed parietal tooth. This is *Partula amanda* Garr., Journ. Acad. Nat. Sc. Phila., IX, p. 59, Pl. III, Fig. 78, and *P. bella* Pse. MS. (non *P. hebe* var. *bella* Pse. Proc.

Zoöl. Soc., 1871, p. 473). Mr. Garrett wrote to Dr. Hartman in 1880: "The *P. amanda* = *P. ventricosa* Pse., and as you say = *bella* Pse. *Ventricosa* was the name I gave the shell when I discovered it. Supposing Pease had abandoned the species I renamed it *amanda*, not being aware of Pease's MS. name *bella*, which precedes mine." *P. amanda* is included among the synonyms of *P. faba* in all Dr. Hartman's catalogues. Garrett (MS. Catalogue) says it is from Tahaa.

4102. "*Partula amanda* Garr. MS. = *faba* var. in A. N. S., Raiatea." Eight specimens.

4103. "*Partula dubia* Garr., MS. (typical), Tahaa, Coll. Garrett." Nine specimens, varying in color from brown to pale olive. The variety has a parietal tooth, more or less developed. This is *P. dubia* Garr., Journ. Acad. Nat. Sc. Phila., IX, p. 57, Pl. III, Fig. 80. In Dr. Hartman's Catalogue of the Genus Partula, 1881, *P. dubia* is placed below *P. fusca* Pse. in a section distinguished by "Pillar tooth always present," but the name is not printed in capitals to indicate a valid species. It is placed among the synonyms of *P. faba* in Dr. Hartman's later works.

4104. Three specimens of a somewhat ventricose pale olive or olive-brown variety of *P. faba*, labeled, on a slip, in Anthony's handwriting: "3. '*ventricosa*' J. G. A., Coll. Pse., J. G. Anth'y." On the slip, in another hand, is "*Hamlin*" and on the card, in Dr. Hartman's handwriting, "Typical"; on the back of the card is written: "Presented by Jno. G. Anthony." This must be the "*P. ventrosa* Anth. MS." placed among the synonyms of *P. faba* by Dr. Hartman, Proc. Acad. Nat. Sc. Phila., 1885, p. 206, and in his MS. work; probably also it is the "*P. ventricosa* Pse. MS." of the same catalogues. In Dr. Hartman's Catalogue of the Genus Partula, 1881, it is given as "*P. ventricosa* Coll. Pse. (Anthony)." *P. ventricosa* Garrett MS. (No. 4158) is a variety of *P. hebe*.

4105. "*Partula brunnea* Pse. MS. = *faba* var., Raiatea, Coll. Pse." Eight specimens, varying in color from castaneous to nearly black, and without bands. The name is placed among the synonyms of *P. faba* in all Dr. Hartman's catalogues.

4106. "*Partula pallida* Pse. MS. = *faba* (white var.), Raiatea, Coll. Pse." Five specimens of a pale olive-brown or whitish shell. One has a parietal tooth and is indistinguishable from the var. *dubia* Garr., No. 4103. See also No. 4096. The name is among the synonyms of *P. faba* in all Dr. Hartman's catalogues.

4107. "*Partula faba* Martyn, var. *marginata*, Tahaa, Coll. Garrett." Eleven adult and three embryonic examples. The form is somewhat ventricose; color dark castaneous with a narrow pale band at the suture. One specimen is much smaller than the others and less ventricose. This is *P. marginata* Garr. MS. The variety is included among the synonyms of *P. faba* in all Dr. Hartman's catalogues. See No. 4100.

4108. "*Partula microstoma* Pse. MS. (typical), Raiatea, Coll. Pse." Twelve specimens, most of them decorticated; color pale with a broad basal and narrow sutural band reddish brown. In one specimen, preserving the epidermis, the ground color is dark olivaceous. There is no pillar tooth. In all his earlier catalogues Dr. Hartman makes this a synonym of *P. vittata* Pse. In his MS. work he says, after his description of *P. vittata*: "*P. microstoma* Pse. MS. Coll. Pse., which has been referred to *vittata*, is probably *P. faba* weather-beaten." Mr. Garrett, to whom Dr. Hartman had sent specimens of the shell, wrote (Jan. 25, 1885): "Your *microstoma* is not typical. It is a large form of *radiata*. Pease's *microstoma* was named from the small size of the aperture; your example has a rather large mouth." See other extracts from the Garrett letters under No. 4309, and Hartman, Proc. Acad. Nat. Sc. Phila., 1885, p. 207.

NOTE.—In Dr. Hartman's MS. and in Proc. Acad. Nat. Sc. Phila., 1885, p. 206, he indicates that two other synonyms of *P. faba* are represented by specimens in his cabinet, viz., *P. biangulata* Pse. MS. and *P. propinqua* Pse. Ms. No shells so labeled have been found in the collection. Perhaps they are included under Nos. 4094–4097.

4109. "**Partula fusca** Pse. (Coll. Pse., typical), Raiatea." On the back of the card is written: "The two lower rows of examples on this card are probably hybrids between *fusca* and *faba*." Eleven specimens, the two lower rows including seven which are slightly larger than the others, and larger than any others in the collection referred to *P. fusca* or its synonyms. All are dark chestnut-colored, generally with a broad, indistinct paler band at the periphery; in three or four the band is not obvious.

Mr. Garrett wrote (Jan. 25, 1885): "*P. protea*, *fusca* and *navigatoria* are the most difficult species to study of any inhabiting Raiatea. They are all connected with each other by hybrids, and all are truly protean forms."

4110. "*Partula fusca* Pse. (typical), Raiatea, Coll. Pse., and Garrett." Thirteen specimens, varying in color from dark castaneous to cinereous-brownish, pale olivaceous brown and whitish. Most of them have a parietal tooth. See notes under Nos. 4128 and 4129.

4111. "*Partula protea* Pse. (typical), Raiatea, Coll. Pse., Coll. Garr." Twelve specimens, brown or dark castaneous, generally with an obscure paler band. In color and appearance they closely resemble *P. ovalis* Pse., Nos. 4126 and 4127. See note under 4128. In all Dr. Hartman's catalogues *P. protea* is treated as a variety of *fusca*. The specific identity was well recognized by Mr. Garrett as early as May 8, 1879. He wrote: "*P. protea* = *fusca* and is a strictly ground species."

4112. "*Partula protea* Pse., Raiatea." Seven specimens, brown or pale, without bands, and more or less obviously strigate.

4113. "*Partula protea* Pse. MS. (white var.), Raiatea, Coll. Garr." Five specimens, pale with obscure oblique brownish strigations. One has a well-developed parietal tooth.

4114. "*Partula protea* Pse. MS., Raiatea, Garrett datum." One specimen. The shell is shorter than usual, with the last whorl slightly angulated; the surface is marked with fine broken spiral lines of a whitish color, apparently produced by some incrusting substance in the spiral sculpture. Possibly this is the shell which Dr. Hartman sent to Mr. Garrett for comparison, with the label *P. lugubris*, and which Garrett returned, January 25, 1885, with the following note: "Your *P. lugubris* is certainly not Pease's species described by him in the P. Z. S. 1864. Neither did I find anything like it in the valleys inhabited by *lugubris*. It is a form of *fusca*, and was collected in the Vaioare Valley."

4115. "*Partula protea* Pse. (abnormal), Raiatea." Three specimens of the banded variety, all with the spire much depressed; two show the parietal tooth.

4116. "*Partula protea* Pse. MS. From the British Museum. Marked *P. navigatoria* Pfr., Coll. Pse." On the back of the card is written: "Sent by the British Museum." Five specimens, one dark castaneous, obsoletely banded, three castaneous, banded, and one pale. Carpenter referred *P. protea* to *P. navigatoria* Pfr.

4117. "**Partula citrina** Pse. (typical), Raiatea." Eight specimens. In his earlier catalogues Dr. Hartman placed this among the synonyms of *P. faba*. In Proc. Acad. Nat. Sc. Phila., 1885, p. 207,

he gives it specific rank in deference to the opinion of Mr. Garrett, and it is so allowed in his later writings. Mr. Garrett wrote, September 8, 1880: "*P. citrina* is most certainly a good species and differs more from *faba* than *thalia* and *compacta* do from *auriculata*. Mr. Pease did not have many specimens. The last time I visited the locality I collected over 800 specimens, most of which I sent to Mus. Godeff. It is remarkably uniform in all its specific characters. I never had the slightest doubt of its specific value."

4118. "**Partula vittata** Pse. (typical), Raiatea, Coll. Pse." Eleven specimens. Two of these are darker and without the parietal tooth, approaching some of the examples referred to *P. fusca* var. *protea*, No. 4111.

4119. *Partula vittata* Pse., Raiatea, Coll. Pse." Three specimens. It is doubtful if these are really *P. vittata*. They are considerably larger and more elongate than other examples referred to *P. vittata* or its synonyms, and resembling those included under No. 4129 (*P. navigatoria*), differing principally in having an obscure pale band; one is without the parietal tooth. Mr. Garrett wrote to Dr. Hartman (February 12, 1883): "*P. navigatoria* is frequently banded."

4120. "*Partula terrestris* Pease MS., Raiatea, Coll. Pse." Twelve specimens; five dark castaneous, four castaneous with a broad pale band and three pale. In Dr. Hartman's earlier works this is made a synonym of *P. approximata* Pse.; in his later ones both are included as varieties of *P. vittata* Pse. See notes under No. 4128.

4121. "*Partula approximata* Pse. MS., Raiatea, Colls. Pse. and Garr." Fourteen specimens, most of them brown in color, including one depauperated form, one albino, and one with distinct oblique streaks; the latter is indistinguishable from small examples included under No. 4129 (=*P. navigatoria*). In Dr. Hartman's earlier catalogues *P. approximata* is treated as a distinct species, with *P. terrestris* as a synonym; in his later works both are included as varieties under *P. vittata*.

4122. "*Partula approximata* Pse., Raiatea." Four specimens, showing extremes of variation in size and form.

4123. "*Partula approximata* Pse. MS. (dark var.), Raiatea, Coll. Pse." Twelve specimens, all dark castaneous or brown. In several the parietal tooth is wanting or rudimentary.

NOTE.—This is perhaps the same as *P. castanea* Pse. MS., which Dr. Hartman placed among the varieties of *P. vittata*, Proc. Acad.

Nat. Sci. Phila., 1885, p. 207, with a † indicating that he had specimens in his own cabinet. No shells labeled *P. castanea* have been found.

4124. "*Partula approximata* Pse. MS., Raiatea, Garr." Eight specimens. Two are pale brownish, the others reddish brown with a broad yellow band, corresponding to the banded specimens included under No. 4120 except that the colors are brighter. (See No. 4125, below, and notes under 4142 and 4170.) All the specimens included under No. 4124 have the umbilicus entirely closed, as in *P. imperforata*, No. 4170; in Nos. 4118–4123 the umbilicus is generally a little open.

4125. "*Partula ovalis* Pse." One specimen, somewhat immature and with the aperture slightly distorted as if pressed toward the left. Color orange brown with a broad yellow band. It is mounted on a small card, different from the cabinet cards used by Dr. Hartman; the name is carelessly written and there is no indication of locality; it appears, in fact, to be a temporary mount. It differs from *ovalis* in color and in the closed umbilicus, and in both these characters it agrees with *approximata* (=*radiata*), No. 4124; from the latter it differs in having the lip less developed and being without the parietal tooth; but this may be due to immaturity.

It is possible that this is the specimen labeled *P. ovalis*, which was sent to Mr. Garrett and returned, as appears from the Garrett letters. Mr. Garrett wrote (Jan. 25, 1885): "Your *ovalis*, which is not a symmetrical example, has the aperture slightly pressed toward the left. It is widely different from my *ovalis*. It is one of the forms of *fusca* inhabiting Vaioare Valley. It may be a hybrid between *fusca* and *navigatoria*." The specimen, however, has no resemblance to *P. navigatoria*, and the shell referred to may have been a specimen of the true *ovalis*.

4126. "**Partula ovalis** Pse. (type) (typical, H. H. S.), Raiatea, Coll. Pse." Twelve specimens, varying considerably in size and form. Color dark castaneous or brown, three or four examples showing a yellow band more or less apparent.

4127. "*Partula ovalis* Pse., Raiatea." Seven specimens, larger than those included under No. 4126 and of a uniform dark castaneous color. They are hardly distinguishable from No. 4111 (*P. protea*, = *fusca*), except by the absence of the parietal tooth, and perhaps they should be referred to that species. Dr. Hartman long regarded *ovalis*

as a synonym of *fusca*, to which *protea* was also referred: this was partly owing to erroneous labels in the Pease and other collections, which were repeated in the Hartman cabinet. When, later, he separated *ovalis* (MS. Catalogue), it does not appear that he corrected his labels to correspond with the separation. Hence No. 4127, though labeled *P. ovalis*, may really belong with No. 4111 among the varieties of *P. fusca*. See notes under 4128, below.

4128. "*Partula fusca* Pse. (typical), Raiatea, Coll. Pse." On the back of the card is written: "The type *fusca* in Coll. Pse. are like these and = *ovalis* Pse. These are the young of *ovalis*." Six specimens, all somewhat immature and uniform dark castaneous in color. See Hartman, Proc. Acad. Nat. Sc. Phila., 1885, pp. 207–208, where he observes: "The type examples of *fusca* (Coll. Pse.) are immature shells of the uniform dark fuscous *ovalis*, two quarts of which were included in the Pease duplicates, labeled *P. ovalis* by Pease. The shell is solid, of a uniform dark chestnut-brown or fuscous color, with a white expanded lip, and the pillar tooth is absent. I have seen several suites labeled *fusca*, from the hands of Mr. Pease, in which the banded *ovalis* and *protea* predominated."

Mr. Garrett wrote (Jan. 25, 1885): "After Pease sent his nine sets of *Partula* to London he had no duplicates left of *fusca* or *citrina*." It is, perhaps, impossible to identify the form which Pease originally described as *P. ovalis;* he did not figure it, and his description would apply to varieties of two or three species. Through shifting of labels or carelessness, two or three distinct forms among his duplicates became known by this name. Dr. Hartman supposed it to be a shell which he long regarded as a variety of *P. fusca* Pse., but eventually separated as a valid species in his MS. work; it appears doubtful, however, whether he made a corresponding change in his labels. As nearly as can be ascertained, the shells which he meant to separate as *ovalis* are No. 4126, labeled *ovalis*, and No. 4128, labeled *fusca;* No. 4127, labeled *ovalis*, is doubtful and may eventually be referred to *fusca;* No. 4125, labeled *ovalis*, is certainly not that species.

Most of the Peasean names were adopted from Garrett's provisional ones, but this was not the case with *ovalis;* hence Garrett, when he sold his collection to Pease, retained no duplicates with that label. Subsequently he attempted to identify it from the description, but was never quite sure, as appears from his letter of February 10, 1879, in which he says: "I have only five specimens of what I now call the

true *ovalis*, two of the banded variety and three of the type. The shells I formerly supposed to be *ovalis* I now refer to *lugubris*. On looking over my journal I see recorded the discovery of a new ground *Partula* in the Faaloa Valley on the east coast of Raiatea, and I gave it the provisional name *castanea*. Mr. Pease, when he bought my collection, adopted all my provisional names which I gave to each species when discovered. As I did not use the name *ovalis*, I have every reason to believe that he renamed the shell. His description accords much better with (my) *castanea* than with the shell I formerly supposed to be *ovalis*. It is very closely allied to *vittata*, as you will remark from the description." Subsequently both Dr. Hartman and Mr. Garrett regarded *castanea* Pse. MS. and Garr. MS. as a variety of *vittata* Pse. (see note under No. 4123). Mr. Garrett appears to have returned to his idea that *ovalis* was a synonym or variety of *lugubris*, and he gives it as such in Journ. Acad. Nat. Sci. Phila., IX, p. 79. But it does not appear that this was the shell which Dr. Hartman called *ovalis*, and it is doubtful if Garrett had that form in his collection. They made direct comparisons of specimens. See extracts from Mr. Garrett's letter under Nos. 4130 and 4125; the shell referred to by Garrett, quoted under the latter number, may be the true *ovalis*.

4129. **Partula navigatoria** Pfr. "*Partula variabilis* Pse. = *navigatoria* Pfr., Raiatea, Coll. Pse., Garr. and Geale." Fourteen specimens, varying much in size and form; all are pale brown or cinereous brown, with oblique streaks of a darker color, and without bands. The name *navigatoria* is a misnomer, but has remained in use. Mr. Pease seems to have been in doubt as to the identity of this species. He wrote to Mr. Garrett, April 21, 1870 (quoted in Garrett's letter, March 15, 1882): "Among the species I have lately determined is '*navigatoria*' (Pfr.) which is a small variety of *faba*." In Pease's list of Polynesian shells, Proc. Zoöl. Soc., 1871, *Partula navigatoria* does not appear. Carpenter referred *fusca* Pse. to *navigatoria*. See No. 4116.

Mr. Garrett wrote to Dr. Hartman, Feb. 12, 1883: "*P. navigatoria* is frequently banded and some forms cannot be distinguished from some elongated forms of *fusca*. Had the former been a strictly ground species I would have made it synonymous with the latter." See under No. 4119 and No. 4109.

4130. "**Partula lugubris** Pse., Raiatea, Coll. Pse." Six specimens, four immature and much smaller than the others. Five are dark brown, lighter above, with a narrow pale peripheral band; the other (imma-

ture) is pale with a narrow dark band. It is evident that Dr. Hartman doubted the validity of this species, which was not abundantly represented in his own cabinet. In his first catalogue (1881) he makes it a synonym of *fusca*. Later, in Proc. Acad. Nat. Sc. Phila., 1885, p. 208, he follows Garrett in considering it distinct; the name does not appear in the "Nautilus" catalogue, Nov., 1892, but was perhaps omitted by mistake. In his MS. catalogue he treats it as a valid species, with *P. ovalis* Garr. (non Pse.) as a synonym. See extract from Mr. Garrett's letter under No. 4128. In the same letter (Jan. 25, 1885) he says: "I send you one of my poor specimens of *lugubris* and one of *ovalis* (= *lugubris*, dark var.). In some very old specimens of *lugubris* the outer lip is more labiated than in the example I send and the upper portion of the labiation is slightly emarginate, and some have a slight tubercle beneath and next to the emargination."

4131. "*Partula lugubris* Pse. (typical), Raiatea, Coll. Pse." Eleven specimens, only three or four fully mature. Two are pale with a darker band; seven are dark with a pale band; two are entirely dark.

4132. "**Partula radiata** Pse. MS., Raiatea, Coll. Pse." Nine specimens, brown or pale, with oblique strigations and without bands. Most of these examples are larger and more elongate than other specimens of *radiata* in the collection. The species was not described by Pease, and was first figured by Garrett in Journ. Acad. Nat. Sc. Phila., IX, Pl. III, Fig. 45. Mr. Garrett supposed that *P. microstoma* Pse. MS. was a variety of this species. See under No. 4309.

4133. "*Partula radiata* Pse. MS. (white var.). Distributed as *P. compressa* Pfr.; Raiatea, Coll. Pse." (See Hartman, Proc. Acad. Nat. Sc. Phila., 1885, p. 208, and MS. cat.) Twelve specimens, pale and obliquely strigate, without bands. All are much smaller than those included under No. 4132; five are compressed and slightly angulate on the body whorl.

4134. "*Partula radiata* Pse. MS. (banded var.), (type) (typical, H. H. S.), Raiatéa, Coll. Pse." Thirteen specimens, varying much in size and form; in several the bands are indistinct or wanting. Compare No. 4108.

4135. "*Partula radiata* Pse.? or hybrids, Raiatea." Seven specimens, all pale and some with only traces of the oblique streaks. Compare No. 4310.

4136. "**Partula planilabrum** Pse. = *suturalis* Pse. MS., Raiatea." Nine specimens, all dark castaneous with a narrow pale sutural band. Mr. Garrett wrote to Dr. Hartman, Feb. 10, 1879: "*P. suturalis* is the name I gave to one of the Tahaa species, and finding it preoccupied Mr. Pease changed it to *planilabrum*." The species is also ascribed to Tahaa in a list of the Society Island Partulas sent to Dr. Hartman by Mr. Garrett, May 25, 1882. Dr. Hartman, in his MS. catalogue, gives the locality: "Haamene Valley, E. coast of Raiatea." Perhaps Tahaa should be substituted for Raiatea. As Mr. Garrett resided in the Society Islands, he could hardly have been mistaken about the habitat of a species which he had personally collected.

4137. "*Partula planilabrum* Pse. (banded var.) Raiatea, Coll. Pse." Seven specimens, showing a broad peripheral band in addition to the narrow sutural one. One is entirely pale, with obscure bands.

4138. "**Partula auriculata** Brod. (typical) Raiatea, Coll. Pse." Fourteen specimens, all dark, with a broad yellowish band on the body whorl; in some the band is nearly obsolete. Mr. Garrett observes in a letter to Dr. Hartman, Feb. 10, 1879: "Reeve's figs. 11a and 16b are both *auriculata*, the latter the type and the former a variety with a broad yellowish band in the middle of the body whorl. It agrees exactly with examples in my collection."

4139. "*Partula auriculata* Brod., Raiatea Isld., Geale datum." Twelve specimens, varying in color from very dark brown to whitish; several are more or less obviously banded. The examples are somewhat smaller than those included under No. 4138.

4140. "*Partula robusta* Pse. MS. (dark var.), Raiatea, Coll. Smithsonian, Coll. Pse." Fourteen specimens, light brown or pale, with oblique brown strigations and without any trace of bands; four are whitish, with obsolete strigations, and may be considered albinos. The shells are less robust than those of the typical *auriculata*, Nos. 4138 and 4139, and the spire is proportionally shorter. *P. robusta* is united with *P. auriculata* in all Dr. Hartman's catalogues.

4141. "*Partula robusta* Pse. MS. (dark var.), Raiatea, Coll. Smithsonian." Twelve specimens, similar in form to No. 4140, but brown, obsoletely strigate, or uniform dark brown.

4142. "*Partula solidula* Pse. MS. (type) (typical, H. H. S.) Raiatea, Coll. Pse." On the back of the card is written: "non Reeve. * * * = *approximata* Pse. * * * = *robusta*" (the reference to *robusta* appears to have been written at a later date). *P. solidula* Reeve (non

Pease) appears to be the same as *compacta* Pse. (see Hartman, Proc. Acad. Nat. Sci. Phila., 1885, p. 209). Three specimens, one much shorter than the other and probably abnormal. In form the normal examples resemble large examples of the typical *auriculata*, No. 4138, and still more some of *P. compacta* Pse., No. 4144; like the latter they have a prominent denticle. In color they are almost exactly like some of the specimens included under No. 4124, referred by Dr. Hartman to *approximata* Pse. MS., = *vittata* Pse. Probably this resemblance led Dr. Hartman at one time to refer the shells to *approximata* Pse. (see Cat. Partula, 1881, p. 7), but the form, the strong denticle and the umbilicus partly open are characteristics of the *auriculata* group. In Proc. Acad. Nat. Sci. Phila., 1885, p. 209, and in the later catalogues, they are referred to *P. auriculata*. The mixture of characters suggests a hybrid.

NOTE.—**Partula gonocheila** Pfr., which Dr. Hartman places next to *P. auriculata*, is not represented by specimens in the collection. There is, however, a drawing of the type specimen in the British Museum by E. A. Smith (No. 4345). This was sent to Mr. Garrett and returned. Garrett wrote (Nov. 25, 1885): "*gonocheila* is undoubtedly a Marquesas species; it has no resemblance to Reeve's figure and differs entirely from any form of *ganymedes*." Reeve gives the habitat "Navigator Islands," and Dr. Hartman, in his MS. catalogue, says it is from Samoa.

4143. "**Partula bilineata** Pse. (typical), Tahaa, Coll. Pse." Nine specimens, variously banded, except one which is white and appears to be an albino.

4144. "**Partula compacta** Pse. (typical), Raiatea, Coll. Pse." Ten specimens, all whitish, except one which is light brown. Cf. No. 4142.

4145. "**Partula thalia** Garr. MS. = *abbreviata* Pse., Raiatea, Coll. Pse. and Garr." Fourteen specimens. The species was published by Garrett in his "Terrestrial Mollusca of the Society Islands," Journ. Acad. Nat. Sc. Phila., IX, p. 69, Plate III, Fig. 46.

4146. "*Partula thulia* Garr. MS. (depauperated), Raiatea." Four specimens.

4147. "**Partula umbilicata** Pse. (typical), Tahaa, Coll. Garr." Sixteen specimens, varying in color from dark castaneous to white, sometimes with an obsolete darker or paler band at the periphery, or paler at the suture; one, larger and rather more obese than the others, is purplish-brown with a conspicuous pale peripheral band.

Mr. Garrett wrote to Dr. Hartman, Feb. 10, 1879: "*P. umbilicata* is, to my eye, one of the most clearly marked species found in the islands, and is more nearly related to *auriculata* than to *hebe*."

4148. "*Partula umbilicata* Pse. (abnormal)." One specimen. The spire is contorted and much depressed; color nearly white.

4149. "**Partula expansa** Pse. (typical), Samoa." Two specimens. Dr. Hartman, in his MS. catalogue, places this species provisionally next to *P. umbilicata*. In previous writings he gave it various positions, generally with doubt.

4150. "**Partula crassilabris** Pse. (typical), Raiatea." Fourteen specimens, generally brown with an obsolete pale band; one small example is entirely brown and one is an albino.

4151. "*Partula crassilabris* Pse., Raiatea." Four specimens, all small and unicolored, brown or pale brown.

4152. "**Partula rustica** Pse. (type) (typical, H. H. S.), Raiatea, Coll. Pse." Eleven specimens, uncolored brown or pale or with an obscure paler band. Mr. Garrett always regarded this as a valid species. He expresses this opinion in a letter to Dr. Hartman, March 15, 1882, and says that *P. pinguis* is a synonym.

4153. "*Partula rustica* Pse. (typical), Raiatea." Twelve specimens, including two pale or albino.

4154. "*Partula pinguis* Garr., MS. Garr. dat., Coll. Pse." Three specimens of a uniform light brown color. United with *rustica* in all Dr. Hartman's catalogues.

4155. "**Partula hebe** Pfr. (typical), Raiatea, Coll. Pse." Nine specimens, all denuded of epidermis and white, or with the apex tinted. Mr. Garrett observed (March 8, 1879): "I have collected thousands of *hebe* (typical) which inhabits two contiguous valleys, and never found one with epidermis. But *hebe* var. *bella* Pse. and *hebe* var. *ventricosa* Garr.—not Pease—exhibit epidermis, but inhabit other parts of the island."

4156. "*Partula hebe* Pfr. vars., Raiatea." Five specimens. Two are like var. *P. bella* Pse. (No. 4157); two are like *P. ventricosa* Garr. MS. (No. 4158); the fifth is a typical *hebe*.

4157. "*Partula bella* Pse. MS., Raiatea (Coll. Pse.)." Eleven specimens. This is *P. hebe*, var. *bella* Pse., Proc. Zoöl. Soc., 1871, p. 474, included as a variety of *hebe* in all Dr. Hartman's catalogues. The shells have a well-preserved epidermis and the apex is rosy. See under No. 4155.

4158. *Partula ventricosa* Garr. MS., Raiatea, Coll. Garr." Seven specimens. Six of these retain the epidermis but are without the rosy apex of *hebe* var. *bella*; the seventh is an ordinary decorticated *hebe*, probably placed on the card for comparison. See under No. 4155, *P. ventricosa* is included as a variety of *hebe* in all Dr. Hartman's papers, though in the 1881 catalogue he gives the name *ventrosa* by error, and it is so written on the label. *P. ventricosa* Anth. MS. (No. 4104) is a very different shell.

4159. "*Partula globosa* Pse. MS. (typical), Raiatea." Six specimens. It differs from *P. hebe* var. *bella* Pse. (No. 4157) only in being a little smaller and more globose, the rosy apex wanting or less strongly defined. Included among the varieties of *P. hebe* in all Dr. Hartman's catalogues.

4160. "**Partula gibba** Fér. (type) (typical, H. H. S.), Guam, Ladrone Islands." Fourteen specimens, pale purplish brown, pale yellowish or whitish, with a white sutural line, and the apex generally darker. Mr. Garrett, in a letter to Dr. Hartman, Dec. 30, 1884, remarks that when he visited Guam he found *P. gibba* in great profusion.

4161. "*Partula mastersii* Pfr., Guam, Ladrone Islands." Nine specimens. A dark variety of *P. gibba*, preserving the white sutural line. It is referred to *gibba* in all Dr. Hartman's catalogues.

4162. "**Partula bicolor** Pse., Guam, Ladrone Islands, Coll. Pse." Five specimens, pale yellow, with or without a purplish band above the suture. On the back of the card is written: "Sent to Pease by Brazier and picked from three bushels of *P. gibba* from Guam, collected by Brazier's father-in-law, Capt. Rossiter." Brazier wrote to Dr. Hartman, June 18, 1885: "*P. bicolor* Pease was described from three specimens sent by me to him. They were picked out by me from about three bushels of *P. gibba* from Guam, collected by my late father-in-law, Captain Thomas Rossiter, in a French whaler, 45 years ago." See No. 4275.

4163. "**Partula radiolata** Pfr., Guam, Ladrone Islands." Nine specimens. In memoranda written by Dr. Cox about 1881, he says: "*P. radiolata* Pfr. never came from New Ireland, in my opinion; it is from Guam."

4164. "**Partula dentifera** Pfr. (type), (typical, H. S. S.), Raiatea, Coll. Pse." Fourteen specimens. Three or four have a small parietal tooth. (Compare. No. 4166.)

4165. "*Partula decorticata* Pse. MS. = *dentifera* Pfr., Raiatea." Five specimens, decorticated in irregular spots and lines, but otherwise not differing from the typical *dentifera*, to which it is referred in Dr. Hartman's catalogues.

"4166. "*Partula raiatensis* Garr. MS., Raiatea, Garr. datum" Seven specimens. It differs from the typical *dentifera* principally in having a strong parietal tooth and the lip denticle less prominent. The apex is generally rosy. Given as a variety of *P. dentifera* in Dr. Hartman's catalogues. Garrett referred *raiatensis* to *imperforata*. See Hartman, Proc. Acad. Nat. Sc. Phila., 1885, p. 210.

4167. "*Partula raiatensis* Garr. MS., Raiatea. (Garr. dat.)." One specimen.

4168. "**Partula callifera** Pfr., Raiatea." Sixteen specimens, showing only a small range of variation.

4169. "**Partula formosa** Pse. MS., Raiatea, Coll. Pse., Coll. Garr." Twelve specimens, including one albino; five or six have a parietal tooth. The species was figured by Garrett in Journ. Acad. Nat. Sc. Phila., IX, Pl. III., Fig. 49.

4170. "**Partula imperforata** Pse. (typical), Hapi, Raiatea (Coll. Pse.)." Hapi or Hapai is a valley in Raiatea. Fourteen specimens. Six are reddish brown to blackish with a yellow peripheral band; five are pale with one or two reddish brown bands; three are pale. The banded examples are hardly distinguishable from specimens included under No. 4123, referred to *P. approximata* Pse. MS. = *P. vittata* Pse. See also No. 4125 and compare No. 4142. The species was figured by Garret, Journ. Acad. Nat. Sc. Phila., IX, Pl. III, Fig. 53.

4171. "*Partula imperforata* Pse. MS., Raiatea, Coll. Garr." Seven specimens. One is reddish brown with a yellow band; one is yellow with the apex and a peripheral band reddish brown; one is similar to the last with the band obscure; four are pale. The aperture is broader and the lip and denticle less developed than in the specimens included under No. 4170; probably the examples are not quite mature.

4172. "*Partula imperforata* Pse. MS. (unicolored var.), Raiatea, Coll. Pse." Twelve specimens, light brown to pale yellowish, without bands.

4173. "**Partula virginea** Pse. MS., Tahaa." Fifteen specimens, varying from castaneous or ashy-brown to yellowish white; some have a darker apex, and nearly all show a white line at the suture.

4174. "*Partula virginea* Pse. MS., Tahaa." Seven specimens, brown, ashy or pale; some show an obscure darker peripheral band, and in two there is a white band below the periphery.

4175. "*Partula virginea* Pse. MS. var., Tahaa." Nine specimens. Generally smaller than the type and with the umbilicus partly closed.

4176. "**Partula lutea** Lesson (typical) = *lilacina* Pfr., Bora-bora Island, Coll. Garr." Nine specimens.

4177. "*Partula lutea* Less., Bora-bora Island." Two specimens. One is similar to the examples under 4176, but has a rosy apex; the other is ventricose, partly decorticated, and ash-colored (=*P. lilacina*).

4178. "*Partula lutea* Less., ventricose var., Bora-bora." Three specimens.

4179. "*Partula lilacina* Pfr. (typical), Bora-bora Island." On the back of the card is written: "The type example has the epidermis denuded, which gives it a lilac color." Four specimens. One is denuded and is like the ashy or lilac-colored example included under No. 4177; the others differ from *P. lutea* (No. 4176) only in being darker. With the Hartman collection there is a colored drawing (No. 4345), by E. A. Smith, of the type example of *lilacina* in the British Museum.

4180. "*Partula lilacina* Pfr. (dwarf), Bora-bora Island." One specimen.

4181. "**Partula garrettii** Pse., Raiatea, Garrett datum." Nineteen specimens, including one section.

4182. "**Partula otaheitana** Brug. vars., Tahiti." Sixteen specimens, illustrating the variations of this species. Two are dextral and unicolored light brown (= No. 4184); two are elongate, light brown or pale, sinistral (= *P. turricula* Pse. MS.); two are brown, sinistral, without the parietal tooth (= *P. rubescens* Rve.); two are shorter, brown, sinistral (= *P. brevicula* Pse. MS. and *perversa* Pse.); three are sinistral with broad bands (= *P. sinistrorsa* Pse., banded var.); five are pale with narrow bands, or entirely pale (= *P. amabilis* Rve.).

Writing to Dr. Hartman, Oct. 10, 1883, Mr. Garrett says: "Bruguière's type of *otaheitana* is the plain reversed shell from the Fantana Valley. Dillwin's description refers to the same shell. Férrusac figured several varieties to represent Bruguière's species." See No. 4200.

4183. "*Partula otaheitana* Brug. var., Tahiti." Three specimens of a small whitish variety with dark apex.

4184. "*Partula otaheitana* Brug. (dextral variety), Tahiti." Fourteen specimens, pale or reddish brown (= *P. reeveana* Pfr.).

4185. "*Partula rubescens* Reeve, type (typical, H. H. S.), Tahiti, Coll. Pse." Nine specimens, eight sinistral and one dextral (for comparison?). The shells are larger and more elongate than the typical *otaheitana*, brown to pale, the upper whorls tinged with rosy. This name is placed among the synonyms of *P. otaheitana* in all Dr. Hartman's catalogues.

4186. "*Partula sinistrorsa* Pse. MS. = *otaheitana* banded, type (typical, H. H. S.), Tahiti, Coll. Pse." Fifteen specimens. A variety with broad or narrow bands, sometimes obscure. The shells are sinistral except (for comparison) one which is dextral and distinctly banded. The latter is very close to the banded var. of *P. affinis* Pse. See No. 4200.

4187. "*Partula brevicula* Pse. MS. = *otaheitana* var., Tahiti, Coll. Pse." Twelve specimens. A small sinistral form, unicolored brown or pale. The name is included among the synonyms of *P. otaheitana* in Dr. Hartman's catalogue, 1881, and in his MS. work.

4188. "*Partula perversa* Pse., Tahiti, Coll. Pse." Nine specimens, eight sinistral and one (for comparison?) dextral; brown or pale, without bands. This cannot be distinguished from *P. brevicula* Pse. MS., No. 4187. The name *perversa* is a manuscript one. It may have been an attempt to revive *Helix perversa* of Chemnitz. Dr. Hartman gives it as a synonym of *otaheitana* in all his catalogues.

4189. "*Partula crassa* Pse. MS., Tahiti, Coll. Pse." Four specimens, all sinistral. Two of them (probably the typical form) are unusually small, chestnut-colored, polished; the others are light brown or pale, one with a narrow band (= *sinistrorsa*, No. 4186). The name is among the synonyms of *otaheitana* in all Dr. Hartman's catalogues.

4190. "*Partula turricula* Pse. MS. Type (typical, H. H. S.) from Coll. Pse." Two sinistral specimens, one light reddish brown and the other white. This is larger and more elongate than any other variety of *P. otaheitana* in the Hartman collection, though specimens of *amabilis* Rve., No. 4191, approach it. This MS. name is included among the synonyms of *P. otaheitana* in all Dr. Hartman's catalogues. It is not the New Hebrides species which Pease described under the the same name, Amer. Journ. Conch., 1872.

4191. "*Partula amabilis* Rve., Tahiti, Coll. Pse." Eight specimens, all sinistral and rather larger than the typical *otaheitana*. Six are pale yellowish; the others (for comparison?) are banded (= *sinistrorsa* Pse.). *P. amabilis* is given among the varieties of *P. otaheitana* in all Dr. Hartman's catalogues.

4192. "*Partula reeveana* Pfr., Tahiti." Three specimens. A large, pale, dextral form of *P. otaheitana*, with which it is united in all Dr. Hartman's catalogues. On the back of the card is written: "These shells correspond to the type in the B. M." In the Hartman collection there is a drawing of the British Museum type by E. A. Smith (No. 4344). This drawing was seen by Garrett, who wrote, Feb. 12, 1883: "Smith's figure of *reeveana*, which I return, is undoubtedly one of the forms of *otaheitana* from the Fantana Valley, the headquarters of the type as well as forms which cannot be separated from some forms of *lignaria*, *affinis*, *amabilis*, *sinistrorsa*, *rubescens*, etc."

Dr. Cox, in a memorandum written about 1881, expresses his doubts of the habitat, "Solomon Islands," attributed to *P. reeveana*.

NOTES.—In Proc. Acad. Nat. Sci. Phila., 1885, p. 212, *Partula isabellina* Rve. is included among the synonyms of *P. otaheitana*, with a † indicating that there are specimens in the Hartman collection. No shells with this label have been found.

Partula vanikorensis Quoy et Gaim. Dr. Hartman regards this as a valid species and places it next to *P. otaheitana*. It is not represented in the Hartman collection, and the only specimens recorded are the types in the Jardin des Plantes.

4193. "**Partula lignaria** Pse., Tahiti, Coll. Pse. and Coll. Geale." Ten specimens, showing varieties. Two are dark chestnut or bay brown; two are cinereous with obsolete strigations; four are pale with a narrow dark band; one is brownish with a darker band (typical *lignaria*); one is soiled brown with a narrow peripheral band and another below the suture. In Cat. Gen. Partula, 1881, Dr. Hartman considers this shell as a variety of *P. rufa* Less. Subsequently the true *rufa* was discovered, and in the later catalogues *lignaria* is regarded as a valid species, with *affinis* and *nitens* as synonyms. *P. lignaria* Garr. (non Pse.) is a variety of *otaheitana*.

4194. "*Partula lignaria* Pse., Tahiti, (Coll. Garr.)." Five specimens. Three are light brown with a peripheral band (typical *lignaria*); two are similar in color, with oblique streaks and without the band. See No. 4200.

4195. "*Partula lignaria* Pse., Tahiti." Four specimens. A small variety, pale with broad oblique streaks; one is a dwarf and nearly white.

4196. "*Partula lignaria* Pse. var., Tahiti, Coll. Pse." Three specimens. Two are orange-brown with a broad yellow band below the periphery, reappearing on the upper whorls; the other is orange-brown with an obsure yellow band above the periphery. In color the variety approaches *P. nitens* Pfr., No. 4204, but the form is more elongate.

4197. "*Partula affinis* Pse., Tahiti, Coll. Pse." Twelve specimens; reddish brown, or paler and with oblique strigations. *P. affinis* is united with *P. lignaria* in all Dr. Hartman's catalogues.

4198. "*Partula affinis* Pse., Tahiti." Eight specimens; light brown or pale, with faint strigations.

4199. "*Partula affinis* Pse., Tahiti (Coll. Pse.)." Sixteen specimens. Seven are brownish with oblique streaks; six are paler; two are whitish with peripheral and sutural bands.

4200. "*Partula affinis*, Pse. var., Tahiti, Coll. Pse." Twelve specimens. Eight are white and probably albinos; four are pale with basal, peripheral and sutural bands. Regarding the latter Dr. Hartman wrote on the back of the card: "The variety with the brown band is marked in the Jardin des Plantes *P. otaheitana* Fér. var. *fasciata*." Mr. Garrett wrote, Sept. 8, 1880: "The banded var. of *affinis* was, as I said, confined to a single valley eight miles east of Papenoo. Pease mentions it as a variety in his description of *affinis*. When I put up the first sets which Pease sent to England it was labeled *affinis* var. *dubia*. Carpenter referred it to *P. varia* var.!" According to Dr. Hartman, *P. affinis* Garr. (non Pse.) = *otaheitana* Brug.; it appears probable, however, that Garrett is speaking of the true *affinis* Pse., which he regarded as a variety of *otaheitana*. Compare No. 4194, received from Garrett, and No. 4186. The banded examples under the label *P. lignaria* (Nos. 4193, 4194) are larger, more elongate and not so shining.

4201. "*Partula affinis*, Pse., Tahiti." On the back of the card is written: "This example occurred with the Pease duplicates from Tahiti." One specimen, orange brown with an ill-defined yellow band (= *P. nitens* Pfr.).

4202. "*Partula affinis* Pse., var. *bacca* Pse. MS., Tahiti, Coll. Pse." Five specimens. Three are brown, small and short, approaching the

depauperated specimen, No. 4203; two are larger, thin, inflated, pale with a darker apex.

4203. "*P. affinis* Pse. (depauperated)." One specimen.

4204. "*Partula nitens* Pfr., Coll. Taylor." On the back of the card is written: "Sent Smith (E. A. Smith) one example. He says *nodosa*, type. No." Three specimens. Compare Nos. 4196 and 4201. *P. nitens* is referred to *P. lignaria* in all Dr. Hartman's catalogues.

4205. "**Partula clara** Pse. (type) (typical, H. H. S.), Tahiti, Coll. Pse. (rare)." Ten specimens. One is brown; three are yellowish; two are pale brown, banded; four are white. Mr. Garrett wrote, Feb. 10, 1879: "*P. clara* is *not* a Moorea species. It is a very rare local Tahiti species and, like *annectens* and *turgida*, appears to be gradually becoming extinct. I have only three examples in my collection." In his MS. Catalogue Dr. Hartman gives the habitat "southern part of Tahiti."

4206. "**Partula stolida** Pse. (typical), Tahiti." Five specimens, varying in color from bay brown to yellowish. In his MS. Catalogue Dr. Hartman says that the species is from "Papenoo Valley, N. E. coast of Tahiti."

4207. "**Partula filosa** Pfr. = *lineolata* Pse., Tahiti." Twelve specimens, castaneous to pale yellowish, with oblique white strigations. In the Hartman collection there is a drawing by E. A. Smith of the type *filosa* in the British Museum (No. 4345). Mr. Garrett, who saw this drawing, agreed with Dr. Hartman that the species was the same as Pease's *lineolata* (letter of Nov. 25, 1883), and he gave *filosa* the priority in his paper on Society Island shells. In previous letters he had expressed a doubt of the habitat, "Navigator Islands," attributed to *filosa* by Pfeiffer.

4208. "**Partula nodosa** Pfr. (type) (typical H. H. S.), Tahiti, Coll. Taylor." Six specimens, brown with a white sutural band and oblique strigations. Two examples have white peripheral bands interrupted by the strigations, and in one the entire base is pale; these approach the more strongly banded examples of var. *trilineata*, No. 4209. In his MS. catalogue Dr. Hartman gives the habitat "Panaavia Valley, North Coast, Tahiti."

4209. "*Partula nodosa* Pfr. = *trilineata* Pse., Tahiti." Fourteen specimens. Well characterized by the three narrow dark bands on a paler ground; in several the bands are broader and the ground color is clouded by strigations. This is *P. trilineata* Pse., Amer. Journ.

Conch., 1866, p. 185; 1867, p. 81, Pl. I. Fig. 1, and *P. nodosa* var. *trilineata* Pse., Proc. Zoöl. Soc. London, 1871, p. 473, the habitat ascribed to it being Moorea. Dr. Hartman in his MS. catalogue described *trilineata* as the typical form of *nodosa*.

4210. "**Partula compressa** Pfr. (typical), Fiji Isl." Four specimens. See No. 4133.

NOTE.—**Partula lineata** Less. This doubtful species, which Dr. Hartman places after *P. compressa* in his MS. catalogue, is not represented in the Hartman collection. In Proc. Acad. Nat. Sc. Phila., 1885, p. 213, the name is given with a † indicating that Dr. Hartman had specimens in his cabinet; but this is evidently a mistake, as the context shows that he relied solely on Lesson's figure and description. Mr. Garrett wrote to Dr. Hartman, Jan. 5, 1884: "I think Lesson's *lineata* may be considered a lost species. I regret using the name in my paper." He refers to his paper in Journ. Acad. Nat. Sc. Phila., IX, p. 50, where he erroneously identifies a variety of *suturalis* Pfr. with *lineata;* in this he followed Reeves' figure. In a letter from Mr. Brazier to Dr. Hartman, June 18, 1885, he says: "I doubt very much of *P. lineata* Less. being found at Oualan. I was there fourteen days and went once across the island from Cheobel (Chabroul?) Harbor to Coquelle Harbor, and never saw anything like Lesson's figure. I found all other species of Helices that were described by Pease before I ever went there."

Writing June 11, 1887, Mr. Layard observes: "If Oualan is in the Fijis, it should be Ovalau, on which Levuka is situated." Probably Dr. Hartman adopted this suggestion, for in his MS. work the habitat given for the species is "Ovalau." It should be noted, however, that Lesson described at least one other species (*Partula rufa*) from Oualan, where it was subsequently found by Brazier.

4211. **Partula suturalis** Pfr. "*Partula vexillum* Pease, Moorea Isld." Seven specimens, five dextral and two sinistral. All are pale yellowish with two or three narrow reddish-brown bands, and without strigations; the parietal tooth is present in all the examples. The dextral specimens closely resemble some included under the var. *P. alternata* Pse (see No. 4213). According to Dr. Hartman (MS. catalogue) the type examples of *P. suturalis* Pfr. are like *P. vexillum* (dextral form?) and *vexillum* is given as a synonym of *suturalis*, which has precedence, in the later Hartman catalogues. Mr. Garrett, Feb. 10, 1879, remarks that *vexillum*, *elongata* (= *tæniata* var.) and *sim-*

ulans (= *tæniata* var.) were found associated in a valley; and he says that sinistral *vexillum* are rare as compared with the dextral form. Apparently he uses the name *vexillum* in a broader sense, including *alternata*. None of the other varieties of *suturalis* are represented in the Hartman collection by sinistral examples.

4212. "*Partula alternata* Pse. (type) (typical, H. H. S.), Moorea." Seventeen specimens, all dextral and generally with a small parietal tooth. Six are pale, streaked obliquely with brown, and with only traces of bands; eight have from one to three spiral bands, the strigations being less obvious; three are brown by the coalescence of the strigations. The name is a MS. one. It is given as a synonym or variety of *P. suturalis* Pfr. in all Dr. Hartman's catalogues.

4213. "*Partula alternata* Pse., Moorea." Nine specimens, all dextral, variously banded and strigate; in some the dark bands are so broad that they cover the greater part of the shell. One has two bands, and the strigations are obsolete; this cannot be distinguished from the dextral form of *vexillum*, No. 4211.

4214. "*Partula alternata* Pse., Moorea, Garrett datum." Nine dextral examples, variously banded and strigate.

4215. "*Partula alternata* Pse., Moorea." Nine specimens, all dextral. Only one is banded; one is small, yellow, without obvious bands or strigations; seven are elongate and more or less strigate obliquely.

4216. "*Partula alternata* Pse., Moorea." Two dextral specimens, one a short form of the ordinary streaked variety, with traces of a pale spiral band, the other small, white, obsoletely strigate with brown. Neither shows the parietal tooth.

4217. "*Partula alternata* Pse., abnormal." One dextral specimen of the *vexillum* variety, without the parietal tooth and with the spire contorted and depressed.

4218. "*Partula alternata* Pse. var., Moorea, Marquesas." (Moorea or Morea or Eimeo is one of the Society Islands, H. H. S.) Three specimens of a straw colored variety with obsolete strigations, and white at the suture; two are small and short, with a faint peripheral dark line; the third is elongate, without the line, and without a parietal tooth.

4219. "*Partula strigosa* Pfr., Moorea." Five specimens, all pale with oblique strigations; one has traces of dark spiral bands. Included among the synonyms of *P. saturalis* Pfr. in all Dr. Hartman's catalogues.

4220. "*Partula ornata* Anth'y MS., Moorea." Five specimens, all pale, conspicuously strigate with brown; one has faint traces of spiral bands. Evidently a variety of *P. strigosa* Pfr., = *saturalis*, var.; but the MS. name does not occur in Dr. Hartman's catalogues.

4221. "**Partula mooreana** W. D. Hartman (type), Moorea Isl., Marguesas" (not "Marguesas," but Society Islands, H. H. S.). Nine specimens, three of which are banded. The types used by Dr. Hartman for his description of the species, Proc. Acad. Nat. Sc. Phila., 1880, p. 229. A figure of the species was published by Garrett, Journ. Acad. Nat. Sc. Phila., IX, Pl. III, Fig. 55. The habitat given by Dr. Hartman in his MS. catalogue is "Vaianassa Valley, Moorea." In his original description he states that the shell is from the Vaianai Valley, but this is distinctly contradicted by a letter from Mr. Garrett, Feb. 10, 1879: "The complete peristome and well developed parietal tooth prove the reversed Moorea *Partula* to be full grown. Your suggestion in regard to its being a hybrid is more to the point, and when I first discovered it I nearly came to the same conclusion. The *vexillum* (= *suturalis* Pfr.), *elongata* and *simulans* (*tæniata* vars.) were found associated in a valley (elsewhere stated to be the Vaianai Valley) two miles north of the habitat of the reversed species, and I did not notice a single hybrid between the former and the two latter. We must also take into consideration that sinistral *vexillum* are very rare as compared with the dextral forms; and the specimens under consideration are *all* reversed and very uniform in color and fasciation. Without positive proof I can not see how it can be considered a hybrid."

4222. "**Partula producta** Pse. (type) (typical, H. H. S.), Tahiti, Coll. Pse." Seven specimens, variously banded; in one the bands coalesce, so that the entire shell is dark chestnut colored.

4223. "**Partula tæniata** Mörch, Moorea." Fourteen specimens, all banded, but some very faintly. In Dr. Hartman's catalogue of the Genus Partula, 1881, *tæniata* and its varieties are given as synonyms of *spadicea* Rve.; in later catalogues the preference is given to *tæniata*. Writing Feb. 10, 1879, Mr. Garrett says: "Pfeiffer copied Mörch's description (of *tænita*), which does not harmonize as well as I could wish with the Moorea shell. His "*transversim irregulator plicata*" may possibly refer to the longitudinal lines of growth, and his "*longitudinator striis undulatis*" expresses the spiral incised lines. Mr. Pease excluded *tæniata* (from his list of Polynesian land shells, Proc. Zoöl. Soc., Lond., 1871) on the supposition that it was a Viti

species, as mentioned by Mörch. No doubt the Cumingian collection has the Moorea shell under Mörch's name." Mr. Pease wrote to Garrett, Apr. 21, 1870: "*P. tæniata* Mörch, though credited to the Fijis, does not belong there, as Mörch writes me" (letter from Garrett to Dr. Hartman, March 15, 1882). Hartman (Proc. Acad. Nat. Sc. Phila., 1885, p. 215) observes: "Mörch's habitat, *Fiji Isles*, for *tæniata*, is probably an error, as his examples were purchased of a whale fisher." In one of Mr. Garrett's letters to Dr. Hartman (March 15, 1882,) he says: "I send you three examples of a Moorea *Partula* which agrees well with *P. tæniata* in having the white bands."

4224. "*Partula simulans* Pse. (type) (typical, H. H. S.), Coll. Pse., Moorea." Twelve specimens. They agree in form and size with *P. tæniata* (No. 4223), but only one is banded, the others being uniform brownish or pale, in some examples with obsolete strigations; perhaps the banded specimen was included for comparison. The name is included as a variety of *P. tæniata* in Dr. Hartman's published catalogues, but it was omitted, no doubt by an oversight, from his MS. work. Mr. Garrett wrote, Feb. 10, 1879: "Carpenter considered *simulans* to be a variety of *tæniata*. I suppose Mr. Pease wrote to Mr. Mörch in regard to the shell and from his reply was convinced that it could not be *simulans*, so he published it as new. In his list of Polynesian shells (Proc. Zoöl. Soc. Lond., 1871) he neither records it nor refers it to any other species." Mr. Garrett observes that it was found in a valley, associated with *elongata* and *vexillum* (= *suturalis* Pfr.).

4225. "*Partula simulans* Pse., Moorea." Four specimens, two light brown and the others white with faint spiral bands.

4226. "*Partula simulans* Pse., Moorea (Garr. dat.)." Two specimens of an elongate, tapering, thin form, approaching *P. elongata*; one is white and the other light brown from oblique strigations. The latter may be an immature form of the variety or hybrid, *P. striolata* Pse. (No. 4228).

4227. "*Partula spadicea* Rve., Eimeo, Moorea." Fourteen specimens, all white or very pale brownish, in form approaching the typical *tæniata* but generally shorter. This is united with *tæniata* in all Dr. Hartman's catalogues. See No. 4348.

It appears that Pease, Cox and others referred one of the white Solomon Island shells to *spadicea*. In memoranda which Dr. Cox

sent to Garrett, about 1881, he states that *spadicea* is "from Eddystone Islands, Solomon Islands, and may be from other islands of the same group." Garrett, in sending the memoranda to Dr. Hartman, remarks: "I note that he is sure that *spadicea* is from the Solomon Islands. In a letter received from Mr. Pease, dated some two years before his death, he states that he has received *spadicea* from the Solomon Islands." Again, writing March 15, 1892, Garrett quotes from Pease's letter of April 21, 1870, "*spadicea* Rve. I have found among the Solomon Island species. It does not belong to the Marguesas." The Solomon Island shell referred to is no doubt *P. hastula* Hartman. Mr. Brazier wrote to Dr. Hartman that Pease considered that shell identical with *P. spadicea* (see Proc. Acad. Nat. Sc. Phila., 1886, p. 33).

Mr. Garrett wrote to Dr. Hartman, Feb. 10, 1879: "*P. spadicea* Rve., 'Marguesas.' The figure in his monograph looks very much like some of the forms of *simulans*. You can ascertain whether it is a Moorea shell or not, as you have *every* species inhabiting that island." It appears that Dr. Hartman sent specimens to the British Museum for comparison (see Proc. Acad. Nat. Sc. Phila., 1885, p. 215).

4228. "*Partula striolata* Pse., Moorea, Coll. Pse." Twelve specimens, five of which are unicolored, pale brown; the others are pale with more or less obvious strigations. The name is placed among the synonyms of *P. tæniata* in all Dr. Hartman's catalogues, but in his MS. work he observes: "The variety *P. striolata* Pse. is probably a hybrid between some of the varieties and *P. suturalis* Pfr." Compare No. 4226.

4229. "*Partula nucleola* Pse. MS., Moorea, Coll. Pse." Fourteen specimens. The variety is shorter and more solid than the typical *tæniata* or any of its varieties represented in the Hartman collection. Four are dark chestnut-colored; four are whitish and banded (in color like the typical *tæniata*) and the others are ashy or pale. This name is included among the synonyms of *P. tæniata* in Dr. Hartman's published catalogues, but is omitted in his MS. work, probably by an oversight.

4230. "*Partula elongata* Pse. (type) (typical, H. H. S.), Moorea, Coll. Pse." Thirteen specimens. Three are white with spiral bands similar to those of *P. tæniata* Mörch; the others are pale brownish to white, two showing faint strigations. *P. elongata* is treated as a variety

of *P. tæniata* in all Dr. Hartman's catalogues. Mr. Garrett considered it distinct. Writing Feb. 10, 1879, he stated that he found it in a valley, associated with *vexillum* (= *suturalis*) and *simulans*, and remarks: "Carpenter referred *elongata* to *lineata* var. (presumably Reeve's *lineata*, = *suturalis*) and says it closely resembles a large *gracilis* (= *attenuata* Pse., No. 4235). He was right in the latter conclusion; but he might with almost equal propriety have referred it to *otaheitana* as to *lineata*. Now you write that it is considered to be identical with *repanda* Pfr., a New Hebrides species, an entirely different shell according to the diagnosis."

4231. "*Partula elongata* Pse., Moorea." Four specimens, all white. Two are considerably shorter than the others.

4232. "*Partula elongata* Pse. (vars.), Emeo." The locality name (Eimeo, Moorea) is on a slip pasted to the card, and perhaps in Geale's handwriting. Five specimens. Two are brown, one cinereous and two white with the apex faintly rosy.

4233. "**Partula carteriensis** Quoy et Gaimard, Carteret Isl., New Ireland." Seven specimens, varying in color from pale cinereous brownish to white. Presumably these shells, or some of them, are from the Cox collection. In memoranda written by Dr. Cox, about 1881, he says the species is from Port Carteret, New Ireland.

4234. "**Partula hyalina** Brod. (type) (typical, H. H. S.), Tahiti." Twelve specimens, including one immature and one old shell with the lip greatly thickened. In a catalogue of Partula (undated) which Mr. Garrett sent to Dr. Hartman he gives the localities for this species: "Tahiti (Garr.), Rurutu (De Gage), Mangaia (Garr.). Dr. Hartman, in his MS. work, notes these and adds: "Tumaco (Cuming)." The shells are all white. See No. 4348.

4235. "**Partula attenuata** Pse. (type) (typical, H. H. S.), Raiatea, Coll. Pse." Twelve specimens. Mr. Garrett (MS. catalogue) states that he has collected this species on Tahiti and Raiatea.

4236. "**Partula lirata** Mousson, Lanthali" (probably the locality is Lantala, or Lanthala, Fiji Is.). Six specimens, varying in color from light brownish to white. Dr. Hartman, in Proc. Acad. Nat. Sc. Phila., 1885, p. 216, gives the habitat "Tavinu, Viti Islands" and elsewhere "Tavinu or Somma Is." Mr. Layard, writing June 11, 1887, says: "There are no such places. I suspect the islands of Taviuni and Loma-loma are meant. I collected for six weeks on the first named and for a day or two on the latter and never saw the shell,

but I found it plentiful on Maug-o (written Mago by the missionaries)." Garrett in his MS. catalogue of Partula gives "Vanua Balavu (Garr.), Lantala (Garr.), Taviuni (Garr.). In Proc. Zoöl. Soc. Lond., 1887, p. 187, he gives these localities and adds that Dr. Gräffe found it on Kanathia and Oneata; he says, it lives on foliage near the seashore. Presumably these specimens were obtained from Mr. Garrett.

4237. "**Partula lævigata** Pfr., Coll. Geale." On the back of the card is written "L. 18, W. 8. Don't think this *lævigata*." The numbers are for length and width (not including aperture) in millimeters. The measurements for this species given in Dr. Hartman's MS. Catalogue (following Pfeiffer?) are "L. 19, D. 9," and "Hab.?" agrees with the label, which gives no locality. The word "*lævigata*" on the face of the card appears to have been imperfectly erased. Mr. Geale accompanied Hugh Cuming in Polynesia. One specimen. It is quite closely allied to *P. flexuosa* Hartm. (No. 4238) but is shorter, and the aperture is not so broad and rounded; color pale with a brownish tint and an obsolete peripheral band.

The pencil notes on the back of this card and of No. 4238 appear to have been made at the same time, perhaps when Dr. Hartman left specimens for comparison with E. A. Smith of the British Museum, (see Proc. Acad. Nat. Sc. Phila., 1885, pp. 205–206). Presumably the name "*lævigata*" was partly erased at that time. No reference to this specimen has been found in the Hartmann correspondence, but in a letter from E. A. Smith, Oct. 2, 1884, he speaks of returning a number of shells. As the label is still perfectly legible, it may be presumed that Dr. Hartman allowed it to stand, after being assured of the correctness of the identification. In Proc. Acad. Nat. Sc. Phila., 1885, p. 217, the species is marked with a †, indicating that there is an example in the Hartman collection.

NOTES.—"**Partula micans** Pfr., Proc. Zoöl. Soc., 1852, p. 138." This species is not represented in the Hartman collection. It is noted in his published catalogues, but in his MS. work it is not mentioned either as a valid species or a synonym. Mr. Garrett, writing May 22, 1882, suggested that it might be the same as *P. cinerea* Albers.

Partula cinerea Albers. This Solomon Island species is not represented in the Hartman collection. At one time Dr. Hartman supposed it might be the shell which he subsequently described as *P. flexuosa* (No. 4238). Mr. Garrett, writing May 22, 1882, suggested that it might be the same as *P. micans* Pfr., the measurements being the

same. In Dr. Hartman's MS. work the name is placed next to *P. lævigata*. See under No. 4243.

Partula grisea Less., New Guinea (originally described as a Bulimus). Not in the Hartman collection, and it appears to be a lost species. Dr. Hartman, in his MS. work, places it after *P. cinerea* Albers. Mr. Garrett wrote, May 25, 1882: "Both Lesson's and Albers' descriptions of *grisea*, from New Guinea, most certainly do not coincide with *micans* or *coxi*. It agrees more nearly with the Solomon Island *Partula* which I last sent" (probably *P. flexuosa* Hartm., No. 4238).

4238. "**Partula flexuosa** Hartm. (type), Solomon Isls. Cox datum." On the back of the card is written: "This shell we have been calling *cinerea*. Is it that species? L. 15–20, W. 8–9." The figures are measurements of length and width in millimeters. For the pencil note see No. 4237 and Proc. Acad. Nat. Sc. Phila., 1885, p. 204. Three specimens and a photograph of another pasted to the same card, the word "type" being written underneath the photograph. Types or cotypes of Dr. Hartman's description and figure, Proc. Acad. Nat. Sc. Phila., 1885, p. 204. The habitat given is "St. George's and Eddystone Islands, Solomon Islands." The shells were received from Dr. Cox through Mr. Garrett. Perhaps the photograph represents a specimen which was returned to Dr. Cox, though it corresponds closely to one of the examples on the card. Dr. Hartman's figure does not agree well with the photograph.

4239. "**Partula hastula** Hartm., Simbo or Eddystone Isld., Sol. Islds." On the back of the card is writen: "No. 18 of Brazier, Simbo, Eddystone Isld. Marked *spadicea* by Pease. No. " (see notes under No. 4227). Five specimens. Types of Dr. Hartman's description, Proc. Acad. Nat. Sc. Phila., 1886, p. 33, Pl. II, Fig. 9. The habitat given with the description is "Erromango Island, Solomon, Islands." In the MS. work this is changed to "Erromango Island New Hebrides," in accordance with a letter from Mr. Layard, June 11, 1887, in which he points out the mistake. In memoranda by Dr. Cox, sent to Mr. Garrett and copied by the latter for Dr. Hartman, the habitat of *spadicea* is given as "Eddystone Island, Solomon Islands"; hence, no doubt, the locality given on the label. The shells were received from Mr. Brazier, who had sent many Partulas to Pease; he may have sent this species with an erroneous label, or some similar species from the Solomon Islands.

4240. "**Partula incurvum** Hartm., Rubiana Isl., Solomon Isls." Two specimens and a photograph mounted on the same card. Collected by Mr. Brazier, and the types from which Dr. Hartman drew his description, Proc. Acad. Nat. Sc. Phila., 1886, p. 31, Pl. II, Fig. 3 (corresponding to the photograph). The photograph appears to correspond to the larger and paler example, but possibly represents another which was returned to Brazier.

NOTE.—**Partula woodlarkiana** Hartm., Proc. Acad. Nat. Sc. Phila., 1886, p. 33. This species is represented in the Hartman collection only by two photographs of the same example (No. 4334) mounted on a card and labeled "Partula woodlarkiana Hartm., New Guinea, Woodlark Isld." On the back of the card is written: "The shell was returned to Brazier as requested." In his MS. work Dr. Hartman places this species next to *P. incurvum* Hartm.

4241. "**Partula regularis** Hartm., Savu or Galeria Isl., Solomon Isls." Two specimens, collected by Brazier, and the types of Dr. Hartman's description, Proc. Acad. Nat. Sc. Phila., 1886, p. 31, Pl. II, Fig. 4 (apparently the shorter of the two).

NOTE.—**Partula similaris** Hartm., Proc. Acad. Nat. Sc. Phila., 1886, p. 30, Pl. II, Fig. 1. This species is not represented in the Hartman collection. Probably the type was returned to Mr. Brazier. In Dr. Hartman's MS. work it is placed after *P. regularis* Hartm.

4242. "**Partula corneola** Hartm., Eimeo = Moorea." On the back of the card is written: "Eimeo, Geale, one of the Society Islands. Not in B. Mus. *Partula corneola* Hartm., unpublished." Two specimens, types of Dr. Hartman's description, Proc. Acad. Nat. Sc. Phila., 1886, p. 32, Pl. II, Fig. 6 (the larger of the two). Dr. Hartman observes, *loc. cit.*, "This shell is not found in the British Museum or the Jardin des Plantes and I have only met with it twice in private collections." The habitat, Moorea, needs confirmation and is given with doubt by Dr. Hartman in his description; he remarks that the shell possesses the dome-like apex (aperture?) of the Solomon Island species. Mr. Geale was the companion of Hugh Cuming in Polynesia; Cuming himself was notoriously uncertain in his locality labels, and Geale did not always know where his shells were obtained. Garrett, who collected extensively in the Society Islands, sent large suites of Moorea shells to Dr. Hartman. In one of his letters he states that these included all the Partulas from that island.

In the Hartman collection there are three photographs (mounted on one card), two of the figured specimens of *P. corneola* and one of the other example (No. 4343½).

4243. "**Partula minor** Hartm., Erromango Isld., Dr. Turner, Coll. Cox." A slip pasted on the back of the card has, in Dr. Cox's handwriting: "Collected by Turner at Erromango, Cox. *P. cinerea* Albers." Two specimens, types of Dr. Hartman's description, Proc. Acad. Nat. Sc. Phila., 1886, p. 31, Pl. II, Fig. 5 (the larger of the two). Probably Dr. Cox alludes to this shell in his memoranda written about 1881: "*P. cinerea* Albers is said to be from the Solomon Isles and I send you specimens corresponding closely to the description of that species, but I feel *very* doubtful about it."

The habitat given with the description is Erromango Island, Solomon Islands. As Layard pointed out, the island is not one of the Solomon Islands, but in the New Hebrides group; the mistake is corrected in Dr. Hartman's MS. work.

4244. "**Partula concinna** Pse., Tanna (Tauua, H. H. S.), New Hebrides." On the back of the card is written, "Purchased from the Taylor collection. Was labeled new species, N. Caledonia. This is doubtless *concinna* Pse., New Hebrides." One specimen, evidently the original of the figure published by Dr. Hartman, Proc. Acad. Nat. Sc. Phila., 1886, Pl. II, Fig. 16.

4245. "**Partula coxi** Angas, Ysabel Isld., Solomon Islds., Brazier datum." On the back of the card is written: "Brazier datum. He says this is the species for which he proposed the name *coxi*, Angas MS. Garrett thinks it *pellucida* Pse. Brazier gave Pease this species from the same place." See Dr. Hartman's observations, Proc. Acad. Nat. Sc. Phila., 1885, p. 217, and 1886, p. 32. Seven specimens. These are the types of the species, first described by Dr. Hartman, Proc. Acad. Nat. Sc. Phila., 1886, p. 32, Pl. II, Fig. 7. This species and *P. pellucida* Pse. were collected by Brazier; he gave specimens to Dr. Cox, who appears to have confounded them. In memoranda written by Dr. Cox, about 1881 he says that *P. coxi* was named from specimens which he sent to Angas. "It is from Solomon Islands, from several of them, but I cannot depend upon my information to decide exactly which" (see notes under No. 4246). Dr. Hartman says that his specimens were presented by Brazier and were from the original lot collected by him (Proc. Acad. Nat. Sc. Phila., 1885, p. 217). Mr. E. A. Smith, of the British Museum, agreed with

Dr. Hartman in his identification of this species with *P. coxi* Angas MS. (letter from Smith, Oct. 2, 1884). It was *P. pellucida*, not *P. coxi*, which Brazier gave to Pease.

4246. "**Partula pellucida** Pse., Ysabel Isld., Solomon Islds. (Coll. Cox)." On the back of the card, written with pencil and partly erased, but still legible: "This is the type *nitens*, compared with the example in the British Museum. Young examples." Over this is written in ink: "This is *pellucida* from Brazier's type examples." Three specimens and two photographs mounted on the same card. The photographs agree well with two of the specimens on the card, but may represent other examples which were returned to Brazier. One of them is the original of the figure published by Dr. Hartman, Proc. Acad. Nat. Sc. Phila., 1886, Pl. II, Fig. 17. Dr. Cox sent the specimens to Dr. Hartman, labeled *P. coxi* Angas MS. *P. coxi* and *pellucida*, were collected about the same time by Brazier, and perhaps on the same island. Brazier sent specimens of *pellucida* to Pease, who described the species in Proc. Zoöl. Soc. Lond., 1871, p. 457, but did not figure it. He gave specimens of both species to Dr. Cox, who evidently confounded them, for Angas gave the MS. name *coxi* to specimens which Dr. Cox had sent him, and the latter sent specimens of *pellucida* to Dr. Hartman labeled *coxi*. He gave the true *coxi*, properly labeled, to Garrett, as appears from Garrett's letter of Jan. 25, 1885: "The *P. coxi* you sent is exactly the same as I received from the Doctor (Cox). The small species you refer to *micans* is probably *pellucida* Pse. His 'granulated surface' is only the incremental striæ cutting the spiral lines." The specimens of *pellucida* were, in fact, referred to *micans* by E. A. Smith, of the British Museum, when Dr. Hartman sent them to him for comparison in 1879; he acknowledged his mistake later (letter of Oct. 2, 1884) and Dr. Hartman accepted Garrett's suggestion that the shells were identical with *P. pellucida* Pse. (see his observations under *P. coxi*, Proc. Acad. Nat. Sc. Phila., 1886, p. 32). Garrett had specimens of *pellucida* in his own collection.

There is equal confusion and more uncertainty regarding the habitats of the two species. The specimens of both are labeled "Ysabel Island" in the Hartman collection, but Dr. Hartman gives this locality only for *P. coxi* in Proc. Acad. Nat. Sc. Phila., 1885, p. 217, and in his MS. catalogue; in the same papers *P. pellucida* is said to be from Guadalcanar Island. Garrett gives "Guadalcanar

Island (Brazier)," but he relied solely on the habitat given by Pease.

NOTES.—**Partula hartmani** E. A. Smith. This species is not represented in the Hartman collection.

Partula perlucens Hartm., Proc. Acad. Nat. Sc. Phila., 1886, p. 31, Pl. II, Fig. 2. This species is not represented in the Hartman collection. The two examples from which it was described were received from Mr. Brazier, and probably were returned to him.

4247. "**Partula kubaryi** Hartm. (type), Karakaut Archipelago, Bismarck, N. Britain." One specimen and an embryonic shell. The type of Dr. Hartman's description, Proc. Acad. Nat. Sc. Phila., 1890, p. 284, Pl. III, Fig. 3. It was "received from Mr. Kubary through Dr. Möllendorff, of Manilla."

4248. "**Partula turgida** Pse., Raiatea, Garrett dat. Very rare." One specimen. It was sent to Dr. Hartman in 1881, and Mr. Garrett states that it was one of two which he had in his own collection. In Mr. Garrett's MS. catalogue he assigns this species to Raiatea and stated that he had collected it there. In Dr. Hartman's catalogue, "Nautilus," Jan., 1893, the species is erroneously entered as "*P. turgida* Pfr."

4249. "**Partula arguta** Pse., Huaheine." Three specimens. The locality given in Dr. Hartman's MS. catalogue is Raiatea, but probably this was an error; Garrett, who resided on Huaheine, gives that island as the habitat of the shell both in his published paper on the Society Island land shells and in his MS. catalogue, where he states that he had collected it. Presumably these specimens were received from Garrett. The Huaheine habitat is given in Dr. Hartman's published catalogue, Proc. Acad. Nat. Sc. Phila., 1885, p. 218.

4250. "**Partula annectens** Pse., Huaheine." Three specimens; presumably received from Mr. Garrett. In his MS. catalogue Garrett gives the habitat Huaheine and states that he had collected the shell there. Pease, Proc. Zoöl. Soc. Lond., 1871, p. 73, credits it to Tahiti.

NOTE.—**Partula minuta** Pfr. This species is not represented by specimens in the Hartman collection. There is a drawing, by E. A. Smith, of the type in the British Museum (No. 4345). Garrett, writing November, 25, 1883, says that the shell is unknown to him.

4251. "**Partula ganymedes** Pfr. (typical), Dominique, Marquesas." Six specimens, all with a chestnut-colored peripheral band.

Mr. Garrett, in his MS. catalogue, gives the habitats "Dominique and Taiwate Islands, Marquesas," and states that he had collected it. In a letter, November 24, 1879, he observes: "When Pfeiffer described *P. ganymedes* in Proc. Zoöl. Soc., p. 39, 1846, he recorded it as from the Society Islands. It was brought to Tahiti by the missionaries."

4252. "*Partula ganymedes* Pfr., Dominique, Marquesas." Seven specimens. Two are of the typical variety (No. 4251); two are smaller, brown on the basal half of the body whorl; two are still smaller and brown except a narrow white band below the suture; one is entirely white.

4253. "*Partula ganymedes* Pfr. var., Dominique, Marquesas, Coll. Geale." Six specimens, varying in size. Three are brown with a white band below the suture, and in one of them the body whorl is angulated; two are pale cinereous brown with the upper part of the body whorl white; one is pale with a narrow peripheral band.

4254. "*Partula fasciata* Pse., Dominique, Marquesas." Eight specimens. Smaller than the typical *ganymedes*, white with a narrow peripheral band, or with the lower part of the body whorl brown or ashy, the band obscurely visible on the darker ground. *P. fasciata* is treated as a variety of *P. ganymedes* in all Dr. Hartman's catalogues.

NOTE.—**Partula gonocheila** Pfr. This doubtful species, said to be from the Navigator Islands, is not represented by specimens in the Hartman collection. There is a drawing of the (supposed) type in British Museum, by E. A. Smith (No. 4345). Mr. Garrett, who saw this drawing, wrote: "*gonocheila* is undoubtedly a Marquesas species, and has no resemblance to Reeve's figure, and differs entirely from any form of *ganymedes*." See notes under Nos. 4257 and 4265, and Dr. Hartman's observations, Proc. Acad. Nat. Sc. Phil., 1885, pp. 219, 220. Garrett does not mention the species in his paper on the terrestrial mollusca of the Navigator Islands.

4255. "**Partula recta** Pse. (typical), Mauui and Nukuhiwa, Marquesas." On the back of the card is written: "These are exactly like the Pease types." Four specimens, one with two embryonic shells in the mouth. The examples are pale brown to whitish, and are larger and thicker than the other varieties referred to *P. recta*.

4256. "*Partula recta* Pse. (white var., typical), Mauui and Nukuhiwa, Marquesas, Coll. Pse." Eight specimens, all white. They are smaller, shorter, more glabrous and thinner than the typical *recta*,

No. 4255, agreeing in this respect with No. 4257. They vary considerably in size.

4257. *Partula recta* Pse., varieties, Nukuhiwa and Mauui, Marquesas." Nine specimens, varying greatly in size. All are smaller, shorter, more inflated and thinner than the typical *recta*, No. 4255, and the aperture is much broader; color pale brownish to whitish, sometimes a little darker on the the lower half of the body whorl. The examples of medium size agree well with a drawing by E. A. Smith of the (supposed) type of *P. gonocheila* Pfr. in the British Museum (No. 4345). Dr. Hartman noticed this resemblance (Proc. Acad. Nat. Sc. Phila., 1885, pp. 219, 220) but remarks that the British Museum examples do not agree with Reeve's figure of *gonocheila*, which = *ganymedes* Pfr.

4258. "*Partula strigata* Pse. (typical), Nukuhiwa and Mauui, Marquesas." On the back of the card is written: "This shell is only a dark var. of *recta*." Four specimens, all castaneous or bay-brown, and varying somewhat in size and form. Three of them approach the typical *recta*, No. 4255, in form, but are not so large and heavy; the other is shorter and more inflated, resembling in form some examples of No. 4257. In his first cataloge of Partula, 1881, Dr. Hartman makes *P. strigata* a synonym of *P. varia* Brod., a Society Islands species (see No. 4274); in his later catalogues he treats it as a variety of *P. recta*.

4259. "*Partula strigata* Pse. = *recta* Pse. (yellow variety), Nukuhiwa and Mauui, Marquesas." Ten specimens, pale yellowish-brown or white, and corresponding closely to some of the larger specimens included under No. 4257. See note under No. 4274.

NOTE.—**Partula repanda** Pfr. This species, said to be from New Hebrides, is not represented by specimens in the Hartman collection. There is a drawing by E. A. Smith of the type *repanda* in the British Museum (No. 4345). Mr. Garrett, who saw this drawing, remarked (February 25, 1883) that it resembled some forms of *tæniata*. Dr. Hartman says (Proc. Acad. Nat. Sc. Phila., 1885, p. 220) that some of the light-colored varieties of *recta* in the Pease duplicates resemble *repanda*, but a comparison with the type *repanda* in the British Museum proved them to be distinct.

4260. "**Partula actor** Albers = *zebrina* Gould, Samoa." On the back of the card is written: "These shells are from the Belcher expedition in voyage Sulphur which touched at Samoa." Four specimens.

In Proc. Acad. Nat. Sc. Phila., 1885, p. 220, Dr. Hartman states that the shells were from the collection of the late Mr. Taylor, of England, and that they were obtained by the Belcher expedition, voyage Samarang; Dr. Hartman's copy of the paper has the word "Samarang" erased and "Sulphur" substituted.

4261. "**Partula tryoni** Hartm. (type), Solomon Isles." One specimen, type of the description and figure, Proc. Acad. Nat. Sc. Phila., 1885, p. 204. The shell was originally from the Cox collection. Dr. Cox sent a specimen to Garrett, who enclosed a pencil drawing of it (No. 4346) in a letter to Dr. Hartman, March 15, 1882. Mr. Garrett thought it might be *P. actor* Albers. "The measurements accord exactly. The color of the single example is fulvous white with opaque white irregular spots and short lines. The base is not umbilicated but conspicuously rimate. The tip broadly and evenly expanded, thin and flat." Subsequently Mr. Garret obtained another example from Dr. Cox and sent it to Dr. Hartman, who described it.

4262. "**Partula inflata** Reeve, Dominique, Marquesas." Five specimens. Four are brown, white around the umbilicus and on the upper part of the body whorl; one is white. The habitat given in Dr. Hartman's MS. work is "Marquesas." Garrett, in his MS. catalogue, gives "Dominique, Taiwate, Marquesas (Garr.)." In his published catalogues Dr. Hartman places this species after *P. ganymedes*, which appears to be its proper position; in his MS. work he places it at the head of a group including *P. magdelinæ*, *bellula* and *decussatula*.

4263. "**Partula magdelinæ** Hartm. (type), Magdelina Isl., Marquesas." On the back of the card is written: "*Partula magdelinæ*, Magdelina Island, Marquesas, Garr. New." Four specimens. Types of Dr. Hartman's description and figure, Proc. Acad. Nat. Sc. Phila., 1885, p. 203. In the "Nautilus," Jan., 1893, p. 98, and in his MS. work, Dr. Hartman has changed the name to *magdelina*, perhaps by an oversight. Four specimens, obtained from Mr. Garrett, who collected them, as appears from his MS. catalogue, No. 115.

4264. "**Partula bellula** Hartm., Wapo Island, Marquesas Islands." On the back of the card is written: "Only two of this species found, one at Dominique at an altitude of 2,500 ft., the other at nearly the same altitude at Wapo Island. *P. bellulæ* (sic) Hartm." One specimen, received from Mr. Garret and collected by him, as appears from

his MS. catalogue, No. 116, where he gives the habitat as "Woapo, Marquesas." Type of Dr. Hartman's description and figure, Proc. Acad. Nat. Sc. Phila., 1885, p. 203. It is stated that Mr. Garrett sent a similar shell from Dominique to the Museum Godeffroy.

4265. "**Partula decussatula** Pfr. (type) (typical, H. H. S.), Dominique, Marquesas." Twelve specimens, varying in size. Most of them are somewhat pellucid, with only traces of a peripheral line; but three large ones and one smaller are subopaque, white at the suture, and on two of these the peripheral band is well marked; they look like miniature examples of *P. ganymedes*, No. 4251. Mr. Garrett wrote (Sept. 5, 1882), that he had sent specimens of *P. decussatula* to Mr. Taylor, who had them examined in London; they were identified with *gonocheila* Pfr. He repeats this statement in another letter, Feb. 12, 1883. With the Hartman collection there is a drawing, by E. A. Smith, of the type *decussatula* in the British Museum (No. 4345). Mr. Smith wrote underneath the drawing: "Differs from *gonocheila* (Brit. Mus.) in spire being shorter, lips less reflexed and extremities more converging—mouth large." Mr. Garrett, after seeing this drawing, wrote (Nov. 25, 1883): "The drawing of *decussatula* proves the correctness of your determination of that species. The figure is much better than Reeve's." Perhaps Garrett himself collected these shells and sent them to Dr. Hartman, who determined them; in the Garrett MS. catalogue, No. 114, which he collected at Dominique, is unidentified.

4266. "**Partula rosea** Brod., Huaheine." Twelve specimens, varying in form from elongate to subobese. Four are rosy (one with an obscure yellow peripheral band); one is rosy with the lower part of the body whorl yellow; two are purple-brown, shining, with a yellow band (= *estalliana* Garr. MS., No. 4271); one is entirely cinereous brown; one is short, purple-brown with a broad yellow band; one is salmon colored with a broad yellow band; two are shining reddish, and one of these has a yellow band.

4267. "*Partula rosea* Brod. (abnormal), Huaheine." One specimen of the *purpurascens* variety, with the body whorl and lip distorted around the umbilicus.

4268. "*Partula purpurascens* Pfr., Huaheine." Seven specimens, dark purplish-brown, sometimes with a reddish spire, interior purple, lip lilac-tinted. *P. purpurascens* is treated as a variety or synonym of *P. rosea* in all Dr. Hartman's catalogues.

4269. "*Partula cognata* Pse. MS., Huaheine." Four specimens on one card. The two central ones are orange or yellow, shining, obscurely banded and with a purple spire; these appear to be the var. *cognata*. The one on the left, with "*rosea*" marked underneath, is the same as *P. purpurascens*, No. 4268. The smaller one on the right, with "*varia*" marked underneath, is the same as *P. varia* Brod., No. 4273, though the mouth is unusually small for that species. Possibly the card indicates that Dr. Hartman suspected *cognata* to be a hybrid between *rosea* and *varia*. The two central shells are like *rosea* in size and form, but resemble *varia* in color. *P. cognata*, however, is given as a synonym of *P. rosea* in all Dr. Hartman's catalogues and in the MS. catalogue of Garrett.

4270. "*Partula cognata* Pse. MS. (typical), Huaheine." Eight specimens, all somewhat shining. One is elongate, white, purple at the sutures; one is unicolored, yellow; three are yellow, orange at the suture and on the lower part of the body whorl, the color appearing on the lip; three are yellow, purple at the suture and on the lower part of the body whorl and lip (= *estalliana* Garr. MS., No. 4271).

4271. "*Partula estalliana* Garr. MS., southeast part of Huaheine." Fourteen specimens, three of which are albinos; the others are either purple or orange, with a broad pale or yellow band, which appears on the upper part of the lip. These shells do not essentially differ from most of the examples included under No. 4270. The name does not appear in Dr. Hartman's published catalogues, but in his MS. work it is given as a synonym of *P. rosea* Brod. No doubt the specimens were received from Mr. Garrett.

4272. **Partula calypso** Semp. "*P. thetis* O. Semp., Peleliu, Mus. Godeffroy." One specimen. Dr. Hartman considered this a synonym of *P. calypso* O. Semp., from the same island. See Proc. Acad. Nat. Sc. Phila., 1885, p. 218. In his MS. work he remarks that the species is an aberrant form of *Partula;* he places it provisionally after *P. rosea*. The shells were collected by Semper on Pililu, one of the Pelew Islands. In his MS. work Dr. Hartman erroneously states that it is one of the Samoan Group.

4273. "**Partula varia** Brod., Huaheine." Fourteen specimens. One is whitish (= No. 4274); two are pale with a purple spire, approaching *P. bicolor* Garr. MS. No. 4275; one is chestnut-colored (= *mucida* Pfr., No. 4278); one is small, brown (= *pulchra* Pse., No. 4280); seven are yellow with a dark spire and variously banded

with chestnut; one is chestnut obscurely banded with yellow; one is short, chestnut colored.

4274. "*Partula varia* Brod. var., Huaheine." On the back of the card is written: "This shell in Acad. Nat. Science is marked *P. strigata* Pse. ex auctore." Regarding this note see Proc. Acad. Nat. Sc. Phila., 1885, p. 219, where the name is printed *strigosa* Pse. (cf. No. 4259). The Academy specimen led Dr. Hartman to place *P. strigata* among the synonyms of *varia* in his first catalogue, 1881; subsequently the mistake was corrected. Twelve specimens, ashy, ochraceous or whitish, with a narrow purplish line above the suture.

4275. "*Partula bicolor* Garr. MS., Huaheine." Five specimens, somewhat inflated, yellowish, with one or two whorls of the spire purple brown. Included among the synonyms of *P. varia* Brod. in all Dr. Hartman's catalogues. This is not *P. bicolor* Pse., No. 4162, though originally Garrett may have supposed that *bicolor* Pse. was the same as his shell, which somewhat resembles it. In his MS. catalogue probably written about 1881, he gives" *bicolor* Pse., Guam," and *bicolor* Garr. MS. as a variety of *varia*.

4276. *Partula glutinosa* Pfr., Huaheine, Coll. Pse." On the back of the card is written: "Examples like these in Coll. Cox from Turner, N. Hebrides, not correct; these are from Huaheine." Nine specimens, larger than any of the other varieties of *P. varia*, yellow or pale, sometimes clouded around the umbilicus, and with the lower half of the lip purple tinted. In his catalogue of Partula, 1881, Dr. Hartman gives this as a valid species; subsequently he treats it as a variety of *varia*, in which he agrees with Garrett. See Proc. Acad. Nat. Sc. Phila., 1885, pp. 218–219.

4277. "*Partula perplexa* Pse. MS. (type) (typical, H. H. S.), Huaheine, Coll. Pse." Five specimens. Four are yellow with the spire white, suture and lower part of the body whorl castaneous, the dark color appearing on the inner surface and lip as a purple tint. These shells, in color, are exactly like the purple-banded specimens of *P. cognata* Pse. (= *rosea* Brod.), No. 4270; in size and form they are like No. 4275 and some of the specimens included under *varia*, No. 4273. The fifth specimen (perhaps introduced for comparison) is a dark example of *varia* with a yellow peripheral band. *P. perplexa* is included among the synonyms of *varia* in all Dr. Hartman's catalogues. It is not mentioned in the Garrett MS. catalogue.

4278. "*Partula mucida* Pfr. (typical). Huaheine." Five specimens of a dark chestnut-colored shell, more elongate than the typical *varia*, No. 4273, or the vars. Nos. 4274–4276; the mouth is narrower and the lip more developed. Compare No. 4279. *P. mucida* is placed among the synonyms of *varia* in all Dr. Hartman's catalogues. With the collection there is a water-color drawing by E. A. Smith of the type *mucida* in the British Museum (No. 4345). Mr. Garrett, who saw this drawing, agreed with Dr. Hartman that it was a variety of *varia* (letter, Nov. 25, 1883).

4279. "*Partula huaheinensis* Garr. MS., Huaheine, Coll. Garr." Ten specimens. Four are dark chestnut colored, approaching *P. mucida* Pfr., No. 4278, but smaller; four are yellow, one dark on the spire; two are yellow obscurely banded. In size the average is less than that of most of the varieties of *P. varia*, but greater than *P. pulchra* Pse., No. 4280. In his MS. catalogue, Mr. Garrett makes this a synonym of *pulchra*, which he later regarded as a variety of *varia*. *P. huaheinensis* is given among the synonyms of *P. varia* in all Dr. Hartman's catalogues.

4280. "*Partula pulchra* Pse. (typical), Huaheine, Coll. Pse." Seven specimens. Four are dark castaneous and three yellowish. The smallest of the varieties referred to *P. varia* (see No. 4279). This is *P. varia* var. *pulchra* Pse., Proc. Zoöl. Soc. Lond., 1871, p. 473. It is included among the synonyms of *varia* in all Dr. Hartman's catalogues.

NOTE. — **Partula newcombianum** Hartm., Proc. Acad. Nat. Sc. Phila., 1886, pp. 34, 35, Pl. II, Fig. 13. This species is represented in the Hartman collection only by two photographs mounted on cards (Nos. 4335 and 4336). One (No. 4336), marked "type", is the original of the figure; on the back of the card is written: "The vessel was lost in which the example was returned and the type is lost." Presumably the type example was to have been returned to Mr. Layard, but there is no mention of the loss in the existing Layard letters. The other photograph (No. 4335) is so different as to suggest a doubt whether the label is correct.

4281. "**Partula assimilis** Pse., Rarotonga Island (Coll. Pse.)." Eight specimens. In his MS. catalogue Garrett states that he collected the species on Rarotonga, presumably before he sold his collection to Pease. See No. 4330.

4282. "*Partula cookiana* Mouss MS., =*assimilis*, Rarotonga Island." Five specimens, rather smaller than those included under No. 4281.

4283. "**Partula virgulata** Pse., Rarotonga Island (Coll. Pse.)." Seven specimens, all light sulphur yellow, sometimes with the apex purple. The species is hardly distinguishable from *P. assimilis* Pse., but is treated as valid in all Dr. Hartman's published catalogues. The name *virgulata* does not appear in Garrett's MS. catalogue, though he states that he collected *P. assimilis* on Rarotonga. In Dr. Hartman's MS. work the species is entered, but a blank is left for the description, perhaps indicating that he doubted its validity or was not certain that his specimens were really *P. virgulata*.

4284. "**Partula subgonocheila** Mouss., Fortuna, Friendly Isls." On the back of the card is written "Capt. Brazier datum." Four specimens. The habitat given for this species in Proc. Acad. Nat. Sc. Phila., 1885, p. 219, is "Fortuna and Vavao Islands." Vavao, or Vavau, is a small island in the northern part of the Tonga or Friendly Islands group; Fortuna does not appear on the maps. Garrett, in his MS. catalogue, gives "Tutuila (Gräffe)." Perhaps Fortuna is a locality on Vavao Island.

4285. "*Partula subgonocheila* Mouss., Tutuila." Four specimens, one immature, two probably dead shells, and the fourth in rather poor condition. These shells are considerably smaller than No. 4284, and, as far as can be judged, the lip is orange-tinted, that of No. 4284 being white. It is doubtful if they are of the same species. It is perhaps significant that, in his MS. work, Dr. Hartman has left a blank for the description of this species, as he has for several others. The locality given on the label is also very doubtful; neither *subgonocheila* nor any shell similar to it is recorded from Tutuila by later collectors. The card and the label appear to be older than those of No. 4284.

4286. "**Partula caledonica** Pfr., Sandwich Island = Vate, Havanna Harbour, N. Hebrides." Seven specimens. In Proc. Acad. Nat. Sc. Phila., 1885, p. 222, the habitat given for this species is "Vavua, Tavu, Banks Island, N. Hebrides." In his MS. work Dr. Hartman changes this, in accordance with a correction by Mr. Layard, to "Vanua-lavu, Banks Islands."

4287. "*Partula caledonica* Pfr., Vate or Efate Island or Sandwich Island, N. Hebrides." On the back of the card, lightly written in pencil, is "*pyramis*?" Two specimens, one immature, and the other nearly denuded of epidermis. A photograph of two shells is attached to the same card; one of these seems to be the immature

specimen, and the other is an adult shell, different from the one on the card; this may have been an example loaned by Dr. Cox or Mr. Brazier and subsequently returned. Probably the specimens were sent by Mr. Brazier, June 15, 1882, as appears from his letter of that date. He states that he collected them at Vate or Sandwich Island.

4288. "*Partula pfeifferi* Crosse, Havanna Harbour, Vate Island, N. Hebrides." Two specimens, one marked on the shell "20." A synonym of *P. caledonica*. Crosse proposed the name *pfeifferi*, as *caledonica* is a misnomer.

NOTES.—**Partula brazieri** Pse. Not represented in the Hartman collection. Dr. Hartman, in his Bibliographical Catalogue and in Proc. Acad. Nat. Sc., 1885, p. 222, places it among the synonyms of *P. caledonica* Pfr. Mr. Brazier wrote, Jan. 18, 1885: "It was in 1879 (?) I sent the whole of my Partulas to Pease and in the lot one that I obtained at Tutuila, Navigators, only a single specimen, which he described and figured as *P. brazieri;* he having died shortly after I never received the specimen back." Dr. Hartman alludes to this, Proc. Acad. Nat. Sc. Phila., 1885, pp. 222, 223, and adds: "The example in the Coll. Acad. Nat. Sc., labeled *P. brazieri* Pease, ex auctore, is of the New Hebrides type, and agrees with my example of *turneri*" (*caledonica?*). In his MS. work Dr. Hartman treats *P. brazieri* as a valid species. Garrett, Proc. Acad. Nat. Sc. Phila., 1887, p. 12, doubts its having been obtained at Tutuila. In a letter, Sept. 8, 1880, he expresses the same doubt and adds: "Pease was very careless in regard to localities. He says it belongs to the *conica* group, but his figure proves that it belongs to the New Hebrides type."

Partula turricula Pse. Not represented in the Hartman collection. In memoranda by Dr. Cox, about 1881, he observes that the New Hebrides habitat attributed to this species wants confirmation. It is given with doubt in Dr. Hartman's papers and in his MS. work. The species has never been figured. See No. 4291.

4289. "**Partula carnicolor** Hartm., Aura Island, N. Hebrides." Four specimens, including two immature. Types of Dr. Hartman's description, Proc. Acad. Nat. Sc. Phila., 1888, p. 250, Pl. XIII, Fig. 2 (the more elongate of the two adults). A slip pasted on the back of the card has, in Mr. Layard's handwriting: "*Partula*, No. 407, Aura Isld., N. Hebrides. Scarce, very few received. I send one adult and one young to show epidermis." Probably the other ex-

amples were also sent by Mr. Layard. Aura Island is in the Santo Espirito Group, New Hebrides.

4290. "**Partula albescens** Hartm. (type), Aura Isld., N. Hebrides." A slip pasted on the back of the card has, in Mr. Layard's handwriting: "*Partula*, No. 410, Aura Island, Malo Pass, Espirito Santo Isls., N. Hebrides. May be retained." Four specimens. Type of Dr. Hartman's description, Proc. Acad. Nat. Sc. Phila., 1888, p. 251, Pl. XIII, Fig. 4. Mr. Layard sent the same species from Sitova Island, as appears from the correspondence.

NOTES.—**Partula eburnea** Hartm., Proc. Acad. Nat. Sc. Phila., 1886, p. 33, Pl. II, Fig. 10. This species is represented in the Hartman collection only by two photographs mounted on cards. The first (No. 4339) corresponds to the published figure and is marked "type." On the back of the card is written: "Example returned to Dr. Cox." Probably the example was returned to Mr. Brazier, as Dr. Hartman states, *loc. cit.*, that Brazier had sent the shells; in his MS. catalogue the species is said to be in the "collection of Mr. John Brazier, Sidney, Australia." The other photograph (No. 4340) is of a smaller shell, marked "*Partula eburnea* Hartm. Hab. ?" No doubt this also was returned to Brazier.

Partula proxima Hartm., Proc. Acad. Nat. Sc. Phila., 1886, p. 34, Pl. II, Fig. 11. This specimen is represented in the Hartman collection only by two cards on each of which are photographs of two shells. One (No. 4337) is marked "*Partula proxima* Hartm., Vanua Levu, N. Hebrides." The photographs are separated, and one of them, corresponding to the published figure, is marked "type." On the back of the card is written: "Returned to Dr. Cox." The other (No. 4338) is marked "*Partula proxima* Hartm., Vanua Levu, Banks Islands." On the back of the card is written: "Photos from Coll., Cox, all returned." In the description it is stated that the shells were received from Mr. Brazier, and in his MS. work Dr. Hartman credits the species to the collection of Mr. John Brazier, Sidney; they may have been returned to Mr. Brazier through Dr. Cox. The habitat is Vanua-lavu, Banks Islands.

4291. "**Partula glaber** Hartm. (type), N. Hebrides?" One specimen, marked "type example." On the back of the card is written: "Coll. Pse." Type of Dr. Hartman's description and figure. Proc. Acad. Nat. Sc. Phila., 1885, p. 205. Dr. Hartman observes: "This species was received among other shells as *P. turricula* Pease

New Hebrides (?) without a voucher." Probably the mark on the back of the card is of no value.

4292. "**Partula eximia** Hartm. (type), Anietum Island, N. Hebrides." On the back of the card, in Dr. Hartman's handwriting: "This shell is *P. macgillivrayi* Pfr. Of this I am certain, having compared it with typical *macgillvrayi*." Possibly this note is an extract from a letter, or the card may have been previously used for another shell. One specimen, received from Mr. Layard. It is the type of Dr. Hartman's description, Proc. Acad. Nat. Sc. Phila., 1886, p. 35, Pl. II, Fig. 14.

4293. "**Partula alabastrina** Pfr., Fiji Isls., Coll. Taylor." On the back of the card is written: "This shell was received from Mr. Geale, of London, who was with Hugh Cuming. The measurements agree with the description." Two specimens. *P. alabastrina* was said to be from the Solomon Islands. Dr. Hartman, in his MS. work, gives the habitat "Fiji Islands, Geale," but a blank is left for the description of the species.

4294. "**Partula fraterna** Hartm., Aura Island, N. Hebrides." A slip pasted to the back of the card has, in Mr. Layard's handwriting: "*Partula*, No. 407, Aura Island, N. Hebrides." Two specimens, one not quite mature. Type of Dr. Hartman's description, Proc. Acad. Nat. Sc. Phila., 1888, p. 250, Pl. XIII, Fig. 3. As appears from the Layard correspondence, the name *fraterna* was given by Dr. Hartman on account of the similarity of the species to *P. carnicolor*, from the same island. It is noteworthy that both were labeled 'No. 407' by Mr. Layard. Probably he sent *P. carnicolor* first, and *P. fraterna*, which he supposed to be the same species, later.

4295. "**Partula auraniana** Hartm., Aura Isld., N. Hebrides." A slip on the back of the card has, in Mr. Layard's handwriting: "*Partula*, No. 408, Aura Isld., N. Hebrides. Several stages of growth. They are viviparous. Keep these for yourself." Four mature and seven young and embryonic specimens. Type of Dr. Hartman's description, Proc. Acad. Nat. Sc. Phila., 1888, p. 250, Pl. XIII., Fig. 1. The figure makes the shell too dark below. The epidermis is yellowish horn-color, sometimes rubbed off on the upper part of the body whorl and the spire, leaving the shell white.

4296. "**Partula guamensis** Pfr., Ponape, Asention Isld., Caroline Islds., Brazier dat." Five adult specimens and seven young in various stages of growth. The specimens were sent by Mr. John

Brazier, of Sidney, June 18, 1885. He says: "You will notice that I send you a great many specimens of the *Partula* called *guamensis* Pfr., which Dr. von Martens says is *rufa* Less. Some have a peculiar red line at the periphery." There is a photograph of one of the adult examples (No. 4341). See. No. 4331.

4297. "*Partula guamensis* Pfr., Asention Island, Coll. Pse.; = *ponapensis* Hartm." Six adult and eight embryonic specimens. *P. ponapensis* is the name proposed by Dr. Hartman as a substitute for *guamensis*, which he considered a misnomer. See Proc. Acad. Nat. Sc. Phila., 1885, p. 221. He remarks that specimens in the Cox collection are labeled Asention Island. Pease, in Proc. Zoöl. Soc. Lond. 1871, p. 473, gives the locality Ponape. Probably both Pease and Cox obtained their specimens from Brazier, who, in that case, is the only authority for the habitat. Ponape is one of the Caroline Islands, and Asention, or Ascencion, may be a place on it.

4298. "**Partula rufa** Less., Ouhalan, Brazier dat." On the back of the card is written: "Given by Cox and Brazier." Two specimens, one a dead shell. The latter was received from Dr. Cox. Subsequently Mr. Brazier sent the better example, as appears from Brazier's letter, dated Sidney, June 18, 1885: "As you wish to receive a good specimen of *P. rufa* Less., I send you the best I have." Both specimens were collected by Brazier "on the banks of the Lella River, Chabroul Harbor, Ouhalan or Strong's Island." See Hartman, Proc. Acad. Nat. Sc. Phila., 1886, p. 30, Pl. II, Fig. 15. Oualan or Strong's Island is one of the Caroline Islands. In Dr. Hartman's MS. work the habitat given is "Ovalau." (Fiji Is.) Probably this is a mistake, due to a letter from Mr. Layard, June 11, 1887, in which he says: "If Oualan is in Fiji it should be Ovalau, on which Levuka is situated." Mr. Garrett wrote, September 5, 1882: "I don't think there is any doubt of the Strong's Island *Partula* being Lesson's *P. rufa*."

With the Hartman collection there is an excellent photograph of the two specimens of *P. rufa*, together with one of *P. guamensis* Pfr. (No. 4341); also, two photographs on cards (one of them colored) of *P. rufa* and *Diplomorpha coxi* (Nos. 4342, 4343).

NOTES.—**Partula obesa** Pse. This species is not represented in the Hartman collection. In Proc. Acad. Nat. Sc. Phila., 1885, p. 221, the habitat given is "Fortuna and Vavao Islands," but in his MS. work Dr. Hartman says that the species was described from a single specimen and that the habitat was unknown.

Partula abbreviata Mouss. Not represented by specimens in the Hartman collection. There is a water-color drawing by E. A. Smith of the type example in the British Museum (No. 4345). The form, as shown in this drawing, leads to the suspicion that it may be an abnormal example. The shell is said to be from Tutuila, and was collected by Gräffe.

4299. "**Partula conica** Gould, Upolu, Mus. Godeff." Six specimens, two immature, of the dextral variety. All are dead shells and only one adult has the epidermis tolerably well preserved.

4300. "*Partula canalis* Mouss., = *conica* Gld., Upolu, Mus. Godeff." Five specimens, two dark and three light brown. Dr. Hartman followed Gould in uniting this sinistral shell with the dextral *P. conica*. Others regarded them as distinct. Garrett, who was of this opinion, pointed out that *conica* is smaller and covered with fine incised revolving lines, which, in *P. canalis*, are seen only on the apex and close to the umbilicus (Proc. Acad. Nat. Sc. Phila., 1887, pp. 11 and 12). This observation is confirmed by the specimens in the Hartman collection. Both forms are found on Upolu and Tutuila, and Dr. Hartman mentions other islands in Proc. Acad. Nat. Sc., 1885, p. 222.

4301. "*Partula canalis* Mouss., var. *semilineata*, Tutuila, Mus. Godeff." Three specimens, pale yellowish with a white, translucent spire. One shows the incised revolving lines of *P. conica*, but they are finer and not so distinct.

NOTE. — **Partula bulimoides** Less., said to be from New Guinea. Not represented in the Hartman collection. In his first Catalogue of Partula, 1881, he refers *P. conica* to this species; subsequently he was inclined to regard it as distinct. In his MS. work he remarks: "This shell has never been identified by conchologists. Lesson's brief diagnosis may apply to some varieties of *conica* as well as *faba*. His measurements of the shell, and the locality, require that it should be kept separate."

4302. **Partula macgillivrayi** Pfr. "*Partula turneri* Pfr., Tauua, New Hebrides, Coll., Geale." Four specimens, three light brownish and one yellowish like No. 4303, all with more or less obvious oblique strigations. Dr. Hartman, in all his catalogues, treats *P. turneri* as a synonym of *P. macgillivrayi*. Mr. Cox, in memoranda written about 1881, says: "*P macgillivrayi* Pfr. is from Aneitum, N. Hebrides." "*P. turneri* Pfr. is from Erromango, N. Hebrides."

In Dr. Hartman's MS. work he states that *P. macgillivrayi* is from Erromango and Vate islands; after the synonym *P. turneri* he gives the habitat "Erromango Island, New Hebrides."

4303. "*Partula turneri* Pfr., New Hebrides, Coll. Geale." On the back of the card is written: "*turneri* Dr. T. found on Erromango Island. One, No. 13, yellow, from same island, found by Capt. Brazier. Solid yellow ones like these (several) marked Tauua in Capt. Brazier's Coll." (The latter part of the note appears to refer to specimens which Dr. Hartman received from Mr. Brazier, but probably returned. See Proc. Acad. Nat. Sc. Phila., 1885, p. 222, but the locality there given is Vate or Sandwich Island. In Dr. Hartman's copy of the Academy paper "Tauua" is written after New Hebrides.) Three specimens, all pale yellow.

4304. "*Partula turneri* Pfr., New Hebrides, A. Brot datum." A slip pasted to the card has, in Brot's handwriting: "*P. turneri* Pfr., N. Hebrides (Mousson)." On the back of the card is written: "Presented by Dr. Brot, of Geneva; from Mousson." One specimen, much like the pale brown examples included under No. 4302, but with an obsolete narrow darker band at the periphery. In his MS. work Dr. Hartman observes: "*P. turneri* Pfr. from M. Mousson per Dr. A. Brot, is the same as *P. macgillivrayi* (No. 4302?) from the collection of Mr. Geale, who accompanied Hugh Cuming. Recent examples from Mr. Brazier, Vate, exhibit these as all one species." See No. 4303.

4305. "**Partula pyramis** Hartm., Vate or Efate, Sandwich Isld., N. Hebrides." On the back of the card is written: "Sent me by Thomson from Layard." Two specimens, a photograph of one of them, and another photograph, apparently of a third example, pasted on the same card. Type of Dr. Hartman's description, Proc. Acad. Nat. Sc. Phila., 1886, p. 34, Pl. II, Fig. 12 (the specimen accompanied by its photograph, the shorter of the two). The habitat given is "Vate, Efate or Sandwich Island," and Dr. Hartman remarks that he has three specimens from Mr. Layard and Mr. Brazier. No doubt one of these was returned but a photograph of it was retained.

HYBRIDS.

4306. "*Partula* (hybrids)." Nine specimens. Perhaps a hybrid between *faba* and *vittata* or *radiata*.

4307. "Hybrid between *virginea* and *dubia*, Raiatea." On the back of the card is written: "Sent by Garrett." Five specimens.

4308. "*P. amanda* and *virginea* (hybrid), Raiatea." Three specimens.

4309. "Hybrid between *fusca* and *navigatoria*, (Garrett datum)." On the back of the card is written: "Sent by Garrett as *microstoma*. No." One specimen. In a letter to Dr. Hartman, Aug. 5, 1882, Mr. Garrett says: "The shell I sent you as *P. microstoma* Pse., of which I have only four examples on a tablet, was taken in the same locality where I obtained Pease's type specimens. If, as you suggest, it is a hybrid, it can only be a cross between *faba* and *radiata*, as there was no other species inhabiting that part of the valley. I have other shells from the same locality which I take to be hybrids between the two former species (No. 4310?). It is evident that Pease changed the names of some of his MS. species after I left Honolulu in 1863." On Sept. 8, 1880, Garrett wrote: "The shell I sent you as *microstoma* is correct unless Mr. Pease shifted the name to another species. I named the shell and collected many examples on the trunks of trees near the ground." See under No. 4108. The example resembles some of the specimens of *radiata* Pse., included under No. 4132, *q v.*

4310. "Hybrid between *faba* and *radiata*, Garr." Two specimens. See extract from Mr. Garrett's letters under No. 4309. Compare No. 4135.

4311. "Hybrid between *faba* and *virginea*, Garrett datum." One specimen.

4312. "Hybrid between *faba* and *virginea*, Garrett datum." One specimen.

4313. "Hybrid, *ovalis* and *dentifera*, Raiatea, Coll. Pse." Two specimens.

4314. "Hybrid, *P. dentifera* Pfr." One specimen. The shell looks like a small *P. imperforata*, No. 4172.

4315. "*Partula.* Hybrid between *garrettii* and *thalia*." Two specimens. Yellowish, darker below the periphery.

4316. "Hybrid between *garrettii* and *thalia*." Five specimens, resembling No. 4315.

4317. "*Partula.* Hybrid between *garrettii* and *halia*, Raiatea." Three specimens, smaller than Nos. 4315 and 4316 mouth unusually small; color uniform yellowish.

4318. "*Partula*. Hybrid between *thalia* and *crassilabris*." Five specimens.

4319. Three shells mounted on the same card, labeled respectively, "*thalia*," "hybrid," "*crassilabris*."

4320. "*P. thalia?* or *P. crassilabris*." Two specimens. Compare No. 4151. The examples are perhaps hybrids.

4321. "Hybrid." One specimen, without other label; perhaps a hybrid between *crassilabris* and *rustica*.

4322. "Hybrids between *crassilabris* and *bella*." Three specimens. *P. bella* is a variety of *P. hebe*.

4323 "Hybrid between *rustica* and *hebe*." Two shells, labeled "*hebe*" and "hybrid." The corresponding specimen of *rustica* is missing.

4324. "*Partula*, between *rustica* and *umbilicata*, Raiatea." Two specimens. The name *umbilicata* is nearly illegible and appears to have been written over *fusca*."

4325. "Hybrid between *rufa* and *affinis*, Tahiti, Coll. Pse." *P. affinis* is a variety of *P. lignaria* Pse.; for *rufa* must be understood *P. stolida*, to which *rufa* Less. was at one time referred. Two specimens.

4326. "Hybrid between *P. affinis* and ———." The label is not completed, but the shell is much like No. 4325, except that it is a little smaller and darker. One specimen.

4327. "Hybrids, Moorea." Three specimens; labeled respectively "*elongata*" "hybrid" and "*alternata*." The first is like the typical *tæniata* Mörch (No. 4223) rather than its variety, *elongata*. *P. alternata* is a variety of *suturalis* Pfr.

4328. "*Partula hyalina?* Coll. Geale. (hybrid?)." On the back of the card is written: "Geale sent me this as *spadicea*." One specimen; a pale brownish shell, very little shining. It looks like some of the varieties of *P. tæniata* Mörch, and is certainly not *hyalina*, which is a white shell.

4329. "*Partula garrettii?* and *hyalina* Pse., Coll. Pse." Two specimens.

See also Nos. 4109, 4135, 4228.

MISCELLANEOUS.

4330. "*Partula*." Two specimens mounted on a card, without other label. A pale horn-colored species, resembling *P. assimilis* Pse., No. 4281.

4331. A tube with nine embryonic shells, labeled "*guamensis* Jusseau." No doubt *P. guamensis* Pfr.

There were also seven unlabeled Partulas with the collection, found in a box with No. 4332, and probably intended for sections. These have been referred to *citrina* Pse., *formosa* Pse., *fusca* Pse., *otaheitana* Brug. var. *amabilis* Rve., *lignaria* var. *affinis* Pse., *crassilabris* var. *rustica* Pse. and *thalia* Garr.

SECTIONS.

4332. "*Partula faba* Martyn." Three sections; front, back and side of the shell. In the same box is a pill box with a number of embryonic shells, no doubt of *P. faba*.

4333. "Four sections mounted on one card, labeled respectively "*crassilabris*," "*rustica*," "*recta*" and "*rosea*."

See also No. 4181.

PHOTOGRAPHS.

4334. "*Partula woodlarkiana* Hartm., New Guinea, Woodlark Isld." Two photographs of the same shell, mounted on a card. On the back of the card is written: "The shell was returned to Brazier as requested." The species is not represented by specimens in the Hartman collection.

4335. "*Partula newcombianum* Hartm." Photograph mounted on a card. It represents an immature (?) shell, in form and appearance quite different from the typical *newcombianum*, No. 4336. There are several unmounted copies. Possibly the label is a mistake. The species is not represented by specimens in the Hartman collection.

4336. "*Partula newcombianum* Hartm., Salisboe Isld., (type)." Photograph from which the figure was taken, Proc. Acad. Nat. Sc. Phila., 1886, Pl. II, Fig. 13. On the back of the card is written: "The vessel was lost in which the example was returned and the type is lost."

4337. "*Partula proxima* Hartm., Vanua Levu, N. Hebrides." Two photographs mounted on a card. One is marked "type" and is the original of the figure in Proc. Acad. Nat. Sci. Phila., 1886, Pl. II, Fig. 11. On the back of the card is written: "Returned to Dr. Cox." The species is not represented by specimens in the Hartman Coll.

4338. "*Partula proxima* Hartm., Vanua Levu, Banks Islands." A photograph of two shells, corresponding to the separated photo-

graphs, No. 4337. On the back of the card is written: "Photos from Coll. Cox, all returned."

4339. "*Partula eburnea* Hartm. (type)." Photograph mounted on a card, the original of the figure in Proc. Acad. Nat. Sc. Phila., 1886, Pl. II, Fig. 10. On the back of the card is written: "Example returned to Dr. Cox." The species is not represented by specimens in the Hartman collection.

4340. "*Partula eburnea* Hartm. Hab.? Photograph mounted on a card; it does not represent the same example as No. 4339.

4341. Photographs of two specimens of *Partula rufa* Less., (No 4298) and one specimen of *Partula guamensis* Pfr. (one of the examples included under No. 4296), labeled "*Partula rufa* Less., Ovalan" and "*Partula guamensis* Pfr., Ponape." On the back of the card is written: "Photos from my collection."

4342. "*Partula rufa* Less." "*Diplomorpha coxi* Hartm. (type)." Photographs of these shells, taken together. Both are from the Cox collection, and were returned to Dr. Cox.

4343. Photograph, the same as No. 4342, but colored.

4343½. "*Partula corneola* Hartm., Eimeo, Moorea, Mr. Geale dat." Three photographs, mounted on one card. Two are of the same shell, and are the originals of the figure in Proc. Acad. Nat. Sc. Phila., 1886, Pl. II, Fig. 6. The photographs are of specimens included under No. 4242.

The photographic negatives are not catalogued, as they are unlabeled, and many cannot be identified. Some of them represent specimens from the Cox collection.

DRAWINGS.

4344. "*P. reeveana* Pfr., E. A. Smith, Brit. Museum." A water-color drawing, labeled by E. A. Smith, mounted on a card. On the back of the card is written: "*P. reeveana* Pfr. = dextral *otaheitana*. Drawn by E. A. Smith, conchologist, Brit. Mus."

4345. Water-color drawings of eight species of *Partula*, "types from British Museum," marked respectively: "*abbreviata* Mouss," "*lilacina* Pfr., from type," "*repanda* Pfr.; others are pale yellow," "*filosa* Pfr., ash striping more conspicuous," "*minuta* Pfr., from type," "*gonochelia* Pfr.," "*mucida* Pfr., from type," "*decussatuta* Pfr., differs from *gonocheila* in spire being shorter, lip less reflexed, and extremities more converging—mouth larger." On the back of the

card is written : "These drawings, from types in the British Museum, were furnished by E. A. Smith, F. Z. Soct., Curator of Conchology at the Museum."

4346. Pencil drawing of *Partula tryoni* Hartm. by Mr. A. Garrett, from a specimen in his collection. See No. 4261.

CATALOGUE OF THE GENUS PARTULA FÉR. BY THE LATE MR. ANDREW GARRETT OF HUAHEINE, SOCIETY ISLANDS. WITH EXPLANATORY NOTES BY HERBERT H. SMITH.

The following catalogue was found among the letters sent by Mr. Garrett to Dr. Hartman; it is undated, but appears to have been written about 1881, or, possibly, a year or two earlier. Many of the so-called species included in it were afterwards regarded as varieties by Mr. Garrett himself. The list, however, is still valuable in showing the relationship of varieties, and especially for the careful notes on localities. In the case of species and varieties collected by Mr. Garrett himself these are of prime importance. For the habitats of other species he generally copied from older authors.

Mr. Garrett says: "In this list I give the correct localities, and attach my name to every species which I collected. Mr. Pease, in his list of Polynesian shells (Proc. Zoöl. Soc. Lond., 1871), gives many wrong localities. I named all Mr. Pease's Society Island Partulas when I collected them, and Mr. Pease adopted my names, so I am sure to be right in both names and localities.

"All those species marked with a † are unknown to me. I add references to the original descriptions. All Mr. Pease's MS. species he intended to publish in a monograph of the genus. I tried to get his MSS. but could not succeed."

The explanatory notes are in parentheses, with the initials H. H. S.

1. *Partula auriculata* Brod., P. Z. S., 1832, p. 125; = *robusta* Pse. MS. Raiatea (Garr.)

2. *P. affinis* Pse., Journ. Conch., 1867, p. 244 (either *P. lignaria* Pse. var. or *otaheitana* Brug. var., H. H. S. See No. 4200, Hartman Coll.). Tahiti (Garr.).

3. *P. approximata* Pse. MS. = *terrestris* Pse. MS. (= *vittata* Pse. var., H. H. S.). Raiatea (Garr.).

4. *P. amanda* Garr. MS. = *dubia* Garr. MS. (= *faba* Mart. var., H. H. S.). Tahaa (Garr.).

5. *P. attenuata* Pse., P. Z. S., 1854, p. 672; = *gracilis* Pse., Amer. Journ. Conch., 1866, p. 197; 1867, p. 81, Pl. 1, Fig. 3. Tahiti (Garr.), Raiatea (Garr.).

6. *P. annectens* Pse. (*Bulimus*), P. Z. S., 1864, p. 671. Huaheine (Garr.).

7. *P. arguta* Pse. (*Bulimus*), P. Z. S., 1864, p. 670. Huaheine (Garr.).

8. *P. assimilis* Pse., Amer. Journ. Conch., 1867, p. 230, Pl. 15, Figs. 28, 29; = *cookiana* Mouss. MS. Rarotonga (Garr.).

9. *P. amabilis* Pfr. (*Bulimus*), P. Z. S., 1846, p. 38; = *rubescens* Rve. (pars.?) (= *otaheitana* Brug. var., H. H. S.). Tahiti (Garr.).

10. †*P. alabastrina* Pfr., P. Z. S., 1856, p. 390. (See No. 4293, Hartman Coll., said to be from the Fijis, H. H. S.) Solomon Islands.

11. †*P. actor* Albers, Heliceen, p. 187. Hab.?

12. †*P. abbreviata* Mouss., Journ. de Conch., 1869, p. 339, Pl. 14, Fig. 7. Tutuila (Gräffe.).

13. †*P. brazieri* Pse., Amer. Journ. Conch., 1871, p. 27, Pl. 9, Fig. 5. Tutuila (Pse.).

14. †*P. bicolor* Pse., Amer. Journ. Conch., 1871, p. 26, Pl. 9, Fig. 4. Guam.

15. *P. bilineata* Pse., Amer. Journ. Conch., 1866, p. 201; 1867, p. 81, Pl. 1, Fig. 10. Tahaa (Garr.).

16. †*P. concinna* Pse., Amer. Journ. Conch., 1871, p. 196. Tauua, New Hebrides.

17. *P. conica* Gld., Proc. Bost. Soc., 1848, p. 196. Upolu (Garr.).

18. *P. crassiuscula* Garr. MS. Pacific Islands (Mus. Godeffroy). (Perhaps *P. bellula* Hartm. See Proc. Acad. Nat. Sc. Phila., 1885, p. 203, H. H. S.)

19. *P. canalis* Mouss., Journ. de Conch., 1865, p. 172. (According, to Hartman and Gould, a sinistral variety of *conica* Gld.: Garrett believed it to be distinct. H. H. S.) Upolu (Garr.).

20. *P. Coxi* Angas. Ysabel Island, Solomon Islands.

21. *P. clara* Pse., P. Z. S., 1864, p. 671. Tahiti (Garr.).

22. *P. compacta* Pse., Amer. Journ. Conch., 1866, p. 200; 1867, p. 81, Pl. 1, Fig. 9. Raiatea (Garr.).

23. *P. crassilabris* Pse., Amer. Journ. Conch., 1866, p. 199; 1867, p. 81, Pl. 1, Fig. 6. Raiatea (Garr.).

24. *P. crassa* Pse. = *perversa* Pse. (not Chemn.). (*P. otaheitana* Brug. var., H. H. S.) Tahiti (Garr.).

25. *P. compressa* Pfr. ? = *radiata* Pse. MS. (*P. radiata* Garr.; not *compressa* Pfr., H. H. S.). Raiatea (Garr.).

26. *P. caledonica* Pfr., P. Z. S., 1861, p. 389. New Hebrides.

27. *P. citrina* Pse., Amer. Journ. Conch., 1866, p. 195. Raiatea (Garr.).

28. *P. callifera* Pfr., P. Z. S., 1856, p. 333; = *megastoma* Pse. MS. Raiatea (Garr.).

29. †*P. calypso* Semp., Journ. de Conch., 1865, p. 418, Pl. 12, Fig. 7. Pelew Isls.

30. †*P. cinerea* Albers, Malak. Blat., Vol. 4, p. 98, 1857. Solomon Islands.

31. †*P. carteriensis* Q. et G. (*Helix*), Voy. Astrol, Vol. 2, p. 117, Pl. 9, Figs. 10–11. New Hebrides (Quoy et Gaim.).

32. †*P. decussatula* Pfr., P. Z. S., 1849, p. 131. Navigator and Solomon Islands.

33. *P. dentifera* Pfr., P. Z. S., 1852, p. 85; = *labiata* Pse. MS., Raiatea (Garr.); = *decorticata* Pse. MS. Raiatea (Garr.).

34. †*P. diminuta* C. B. Ads., Ann. Lyc. N. Y., Vol. 5, p. 41 (*P. otaheitana* Brug. var., H. H. S.). Society Islds.? (Garr.).

35. *P. elongata* Pse., Amer. Journ. Conch., 1886, p. 146; 1867, p. 81, Pl. 1, Fig. 2. Moorea (Garr.). (According to Dr. Hartman a var. of *P. tæniata* Mörch; Garrett believed it to be distinct. H. H. S.)

36. †*P. expansa* Pse., Amer. Journ. Conch., 1871, p. 26, Pl. 9, Fig. 3. Tutuila (Brazier). (See 112, H. H. S.)

37. *P. erhelii* Morelet, Journ. de Conch, 1853, p. 371, Pl. 12, Figs. 7–8. Moorea. (= *P. tæniata* Mörch, H. H. S.)

38. *Partula formosa* Pse. MS. Raiatea (Garr.).

39. *P. faba* Martyn (*Limax*), Univ. Conch., Vol. 2, Pl. 67. Raiatea (Garr.).

40. *P. fusca* Pse., Amer. Journ. Conch., 1866, p. 193; = *protea* Pse. MS.; = *variabilis* Pse. (pars.). Raiatea (Garr.).

41. †*P. fragilis* Fér., Prodr., p. 66, No. 4. Guam.

42. *P. gibba* Fér., Prodr., p. 66, No. 3. Guam (Garr.); = *mastersi* Pfr., P. Z. S., 1857, p. 110. Guam (Masters).

43. *P. Garrettii* Pse., P. Z. S., 1864, p. 672. Raiatea (Garr.).

44. *P. ganymedes* Pfr. (*Bulimus*), P. Z. S., 1846, p. 39 ;=*fasciata* Pse., Amer. Journ. Conch., 1866, p. 202. Dominique and Taiwate, Marquesas Islands (Garr.).

45. †*P. gonocheila* Pfr. (*Bulimus*), Zeits. f. Mal., 1847, p. 82 Hab.?

46. *P. guamensis* Pfr. (*Bulimus*), Phil. Icon., Vol. 2, p. 113, Bul., Pl. 4, Fig. 9 ; = *brumalis* Rve., Conch. Icon., Fig. 2. Guam. (Presumably not from Guam ; Brazier collected it on Ponape, Caroline Is., H. H. S.)

47. †*P. grisea* Less., Voy. Coq., p. 325, Pl. 13, Fig. 11. New Guinea.

48. *P. hyalina* Brod., Proc. Zoöl. Soc., 1832, p. 32. Tahiti (Garr.) Rurutu (De Gage) Maugaia (Garr.).

49. *P. hebe* Pfr. (*Bulimus*), P. Z. S., 1846, p. 39 ; = *globosa* Pse. MS. ; = var. *bella* Pse. ; = *ventricosa* Garr. MS. Raiatea (Garr.).

50. *P. huahinensis* Garr. MS.; = *pulchra* Pse. (= *varia* Brod. var., H. H. S.). Huaheine (Garr.)

51. *P. inflata* Rve., P. Z. S., 1842, p. 197; = *thersites* Pfr., Symb., Vol. 2, p. 52. Dominique, Taiwate, Marquesas (Garr.).

52. *P. imperforata* Pse. MS. Raiatea (Garr.).

53. *P. lutea* Less., Voy. Coq., p. 325. Bora-bora (Garr.).

54. *P. lignaria* Pse., P. Z. S., 1864, p. 671. Tahiti (Garr.).

55. *P. lugubris* Pse., P. Z. S., 1864, p. 672. Raiatea (Garr.).

56. *P. lineolata* Pse., Amer. Journ. Conch., 1867, p. 244 (= *filosa* Pfr., H. H. S.). Tahiti (Garr.).

57. †*P. leucothæa* Semp., Journ. de Conch., 1865, p. 417, Pl. 12, Fig. 5. (= *calypso* Semp., H. H. S.) Pelew Islds. (Semper.).

58. *P. lineata* Less., Voy. Coq., p. 324, Pl. 7, Figs. 8–9 ; = *alternata* Pse. Moorea (Garr.), MS. (The locality is for *alternata*, = *suturalis* Pfr., non *lineata* Less., H. H. S.)

59. †*P. lilacina* Pfr., P. Z. S., 1856, p. 334. Marquesas. (= *P. lutea* Less. from Bora-bora, Soc. Is., not Marquesas, H. H. S.)

60. *P. lirata* Mouss., Journ. de Conch., 1865, p. 196. V. Talavu (Garr.) Lantala (Garr.) Taviuni (Garr.).

61. †*P. lævigata* Pfr., P. Z. S., 1856, p. 334. Hab.? Probably a Society Island species.

62. *P. microstoma* Pse. MS. (probably *P. faba* Martyn, or perhaps a hybrid. See Nos. 4108 and 4309, Hartman Coll., H. H. S.). Raiatea (Garr.).

63. †*P. micans* Pfr., P. Z. S., 1852, p. 138. Solomon Is.

64. †*P. minuta* Pfr., P. Z. S., 1856, p. 384. Admiralty Islands.

65. †*P. macgillivrayi* Pfr., P. Z. S., 1855, p. 97. New Hebrides. (*Partula mucida* Pfr. is entered at the end of the catalogue.)

66. *P. nucleola* Pse. MS. (= *tæniata* Mörch. var., H. H. S.). Moorea (Garr.).

67. *P. nodosa* Pfr., P. Z. S., 1851, p. 262. Samoa, Tahiti. (The habitat Samoa appears to be an error, H. H. S.)

68. *P. navigatoria* Pfr., P. Z. S., 1849, p. 131; = *variabilis* Pse., Amer. Jour. Conch., 1866, p. 203; 1867, p. 81, Pl. I, Figs. 12–14. Raiatea (Garr.).

69. *P. nitens* Pfr., P. Z. S., 1854, p. 293. Hab.? (= *P. lignaria* Pse. from Tahiti, H. H. S.).

70. †*P. obesa* Pse., Amer. Journ. Conch., 1867, p. 223, Pl. 15, Fig. 12. Hab.?

71. *P. ovalis* Pse., Amer. Journ. Conch., 1866, p. 144 (probably Garret's specimens were *P. lugubris* Pse., dark var., not *ovalis* Pse., H. H. S.). Raiatea (Garr.).

72. *P. otaheitana* Brug. (*Bulimus*), Enc. Meth., Vol. I, p. 347, No. 84; = *isabellina* Pfr. Tahiti (Garr.).

73. †*P. peasei* Cox, P. Z. S., 1871, p. 644, Pl. 52, Fig. 2. Solomon Islds.

74. †*P. pellucida* Pse., P. Z. S., 1871, p. 457. Guadalcanar Isld., Solomon Isls. (Brazier).

75. †*P. pacifica* Pfr., P. Z. S., 1854, p. 125. Pacific Isls. (= *otaheitana* Brug. var., Tahiti, H. H. S.).

76. *P. purpurascens* Pfr., P. Z. S., 1856, p. 333. Hab.? (= *rosea* Brod. var., Huaheine, H. H. S.).

77. *P. producta* Pse., P. Z. S., 1864, p. 671. Tahiti (Garr.).

78. *P. planilabrum* Pse., P. Z. S., 1864, p. 672. Tahaa (Garr.).

79. *P. pulchra* Pse. MS. = *huahinensis* Garr. MS. (= *varia* Brod. var., H. H. S.). Huaheine (Garr.).

80. *P. pinguis* Garr. MS. (= *rustica* Pse. var., H. H. S.). Raiatea (Garr.).

81. †*P. raiatensis* Garr. MS.; = *abbreviata* Pse., non Mouss. (= *imperforata* Pse. MS. var., H. H. S.) Raiatea (Garr.).

82. †*P. radiolata* Pfr., P. Z. S., 1846, p. 39. Guam (Garr.).

83. *P. rosea* Brod., P. Z. S., 1832, p. 125; = *cognata* Pse. MS. Huaheine (Garr.).

84. *P. recta* Pse., Amer. Journ. Conch., 1868, p. 155, Pl. 12, Fig. 8. Marquesas.

85. *P. rubescens* Rve., Conch. Icon., Pl. 3, Fig. 12; = *turricula* Pse. MS. (= *otaheitana* Brug., H. H. S.) Tahiti (Garr.).

86. †*P. rufa* Less., Voy. Coq., p. 324. Oualan, Caroline Islands. No doubt a Tahiti species. (Not from Tahiti; the species was rediscovered at Ualan. H. H. S.)

87. *P. rustica* Pse., Amer. Journ. Conch., 1866, p. 199; 1867, p. 81, Pl. 1, Fig. 5. Raiatea (Garr.).

88. †*P. repanda* Pfr., P. Z. S., 1855, p. 98. New Hebrides.

89. †*P. reeveana* Pfr., P. Z. S., 1852, p. 138. Solomon Islands. (= *otaheitana* Brug., Tahiti, not Solomon Islands, H. H. S.)

90. *P. solidula* Rve., Conch. Icon., Pl. 3, Fig. 16. (Probably *auriculata* Brod., = *solidula* Pse. MS., non Pfr., H. H. S.) Society Islands.

91. *P. stolida* Pse., Amer. Journ. Conch., 1866, p. 198. Tahiti (Garr.).

92. *P. striolata* Pse., Amer. Journ. Conch., 1866, p. 197; 1867, p. 81, Pl. 1. Fig. 4 (= *taeniata* Mörch. var., H. H. S.), Moorea (Garr.).

93. †*P. strigata* Pse., Amer. Journ. Conch., 1868, p. 155, Pl. 12, Fig. 7 (= *P. recta* Pse. var., H. H. S.) Marquesas.

94. †*P. stenostoma* Pfr., P. Z. S., 1855, p. 17, Hab? Probably a Raiatea species. (=. *P. suturalis* Pfr. var., Moorea, H. H. S.).

95. †*P. suturalis* Pfr., P. Z. S., 1855, p. 18, Hab.? Also a Raiatea species? (from Moorea, identified with *vexillum* Pse., H. H. S.).

96. †*P. spadicea* Rve., Conch. Icon., Pl. 4, Fig. 24. Marquesas. (= *tæniata* Mörch, Moorea, not Marquesas, H. H. S.).

97. †*P. strigosa* Pfr., P. Z. S., 1856, p. 384. Admiralty Isld. (= *suturalis* Pfr. from Moorea, not Admiralty Isld., H. H. S.).

98. *P. subgonocheila* Mouss., Jour. de Conch, 1871, p. 14, Pl. 3, Fig. 4. Tutuna (Garr.).

(*Partula sinistrorsa* Pse. MS. and *P. subangulata* Pse. are at the end of the catalogue).

99. *P. thalia* Garr. MS.; = *peaseana* Garr. (not *peasei* Cox); = *recta* Pease MS. (non *recta* Pse., No. 84). Raiatea (Garr.).

100. †*P. thetis* Semp., Journ. de Conch., 1865, p. 419, Pl. 12, Fig. 6 (= *P. calypso*, Semper, H. H. S.). Pelew Islands (Semper).

101. †*P. tæniata* Mörch, Cat. Conch. Kieralf, p. 29, Pl. I, Fig. 5. Viti Islands. (From Moorea, not Viti Is. Identified with *strioalta* Pse., H. H. S.)

102. †*P. turneri* Pfr., P. Z. S., 1860, p. 40 (= *P. macgillevrayi* Pfr., H. H. S.). New Hebrides (Turner).

103. *P. turricula* Pse., Amer. Journ. Conch., 1871, p. 196. New Hebrides? (See No. 85: this appears to be a different species and perhaps the true *turricula* Pse.; H. H. S.).

104. *P. turgida* Pse. (*Bulimus*), P. Z. S., 1864, p. 670. Raiatea (Garr.).

105. *P. trilineata* Pse., Amer. Journ. Conch., 1866, p. 195; 1867, p. 81, Pl. 1, Fig. 1 (= *P. nodosa* Pfr. var., H. H. S.). Tahiti (Garr.).

106. *P. umbilicata* Pse., Amer. Journ. Conch., 1866, p. 200; 1867, p. 81, Pl. 1, Fig. 7. Tahaa (Garr.).

107. *P. varia* Brod., P. Z. S., 1832, p. 125; = *glutinosa* Pfr., P. Z. S., 1871, p. 473; = *adusta* Garr. MS.; = *bicolor* Garr. MS., Huaheine (Garr.); = *simplaria* Morelet?, Journ. de Conch., 1853, p. 370, Pl. 11, Figs. 13–14. Tahiti. (*P. simplaria* Morelet has been referred to *P. rosea* Brod., H. H. S.)

108. *P. virginea* Pse. MS. Tahaa (Garr.).

109. †*P. vanikorensis* Quoy et Gaim, Voy. Astrol., Vol. 2, p. 115, Pl. 9, Figs. 12–17. Vanikoro (Quoy and Gaim.).

110. *P. vexillum* Pse., Amer. Journ. Conch., 1866, p. 198; 1867, p. 81, Pl. 1, Fig. 18 (= *suturalis* Pfr., H. H. S.). Moorea (Garrett).

111. *P. vittata* Pse., Amer. Journ. Conch., 1866, p. 194. (Probably Garrett's shells were *radiata* Pse. var., non *vittata* Pse., H. H. S.). Raiatea (Garr.).

112. *P. zebrina* Gld., Proc. Bost. Soc., 1848, p. 196; = *recluziana* Petit, Journ. de Conch., 1850, p. 170, Pl. 7, Fig. 5. Tutuila (Gould) Upolu (Garr.). (= *expansa* Pse., Upolu; non *zebrina* Gld., which = *actor* Albers, from Tutuila; H. H. S.).

113. *P. mucida* Pfr., P. Z. S., 1855, p. 98. Pacific Islands (= *varia* Brod., Huaheine, H. H. S.).

114. *Partula* sp. Dominique, Marquesas (Garr.).

115. *Partula* sp. Magdelina, Marquesas (Garr.). (*P. magdelinæ* Hartm., described from specimens sent by Garrett; H. H. S.)

116. *Partula* sp. Woapo, Marquesas (Garr.). (*P. bellula* Hartm.? H. H. S.)

117. *Partula* sp. Moorea (Garr.). (Probably *P. mooreana* Hartm., H. H. S.).

118. *Partula sinistrorsa* Pse. MS. (= *P. otaheitana* Brug. var., H. H. S.). Tahiti (Garr.).

119. *P. subangulata* Pse., P. Z. S., 1871, p. 458 (= *P. faba* Mart. var., H. H. S.). Tahaa, Garr.

The following extracts from the Garrett letters have a general interest in connection with the genus *Partula* :

November 28, 1878: "Following is a list of all the ground species (probably of the Society Islands only, H. H. S.): *approximata*, *pinguis* (= *rustica* Pse.), *planilabrum*, *producta*, *navigatoria*, *fusca*, *lugubris*, *vittata*, *ovalis* (= *lugubris* var.?), *compressa* (= *radiata* Garr.), *rustica* and *crassilabris*. All the others are strictly arboreal. The ground species are only found on Tahiti, Raiatea and Tahaa."

Feb. 10, 1879: "After eliminating the well-marked Tahitian species, such as *P. alternata*, *clara*, *hyalina*, *trilineata*, *lineolata* and *producta* from the other species of that island, we have left a *very* difficult group to study. These include *otaheitana*, *lignaria*, *amabilis*, *rubescens*, etc. They have not the same specific value as those mentioned above. All the former are not connected with each other, or with the latter group, by intermediate forms. With the exception of *producta*, which is a ground species, all the others are arboreal.

Whether the *oatheitana* group includes one or several species will, in my opinion, always remain an open question, for the simple reason that nearly all conchologists disagree more or less in what constitutes a good species. I am not quite satisfied with my own conclusions in regard to some of the species, and in order to clear up doubts it will be necessary to revisit certain localities."

May 8, 1879: "If you adopt my names and localities (for Pease's species) you will have them correct. At least they ought to be, as I collected all Mr. Pease's species as well as named them. Of course, you will use your own judgment in reducing the number of species. I agree with you that some of the species are simply varieties and many synonyms."

March 15, 1882: "There is a good deal of doubt (in the genus *Partula*) in consequence of the uncertainty of the true types, which in some cases cannot be relied on as represented in the British Museum. With regard to Cuming's localities (who collected in this group some forty-five years ago), it really seems as if he intentionally gave the

wrong habitats of some of the shells collected by himself, or marked them 'hab.?' in order to mislead the monographers and make as many species as possible. He did not appear to care so much about shells in a scientific point of view as to possess the largest collection in the world. Nothing vexed him so much as having any one doubt the validity of any of *his* new species, which he selected, generally three of each, from his stock of duplicates. He was also in the habit of changing the author's types whenever he obtained what he supposed to be better specimens. No doubt in most cases he was right in replacing the same species. Still, they were not the author's types."

Under the same date Garrett quotes a letter from Pease, written Apr. 21, 1870. "'I shall close up my monograph of Partula as soon as I receive another consignment from Australia, by which I shall receive several species from New Hebrides and Solomon Islands I am desirous of seeing. I make out ninety-four species, of which the localities of eighty are known, viz., fifty-nine Polynesia and twenty-one Papuan. * * * I have divided the several species into typical groups and given their range of distribution and variation. You have credit over your initials for your notes, and sometimes a little more.'" Mr. Garrett adds: "I wrote to a friend in the Sandwich Islands, shortly after Pease's death, to try and get the MSS. They could not be got. I suppose they were sold with his splendid library."

Oct. 10, 1882: "With regard to Polynesian land shells I have seen nothing to convince me that food has anything to do with the color of the shell. *P. rosea* and *varia*, which are the most variable in color, may in some localities be seen in countless numbers on different species of shrubs and ferns, old and young of the different colored varieties on the same plant. The same may be said of all the species, ground as well as arboreal."

Feb. 12, 1883: "Long ago I wrote you in regard to the confusion of Pease's duplicates, caused by the hurried packing by persons who knew nothing of the importance of keeping the duplicates separate. * * * Pease himself was very careless, and his children, as he wrote me, amused themselves 'sorting his duplicates,' which were in cigar boxes."

Nov. 25, 1883: "I am inclined to believe that many species which are really distinct—especially in the land-shells—gradually merge into each other, just as some genera intergrade."

Jan. 25, 1875. "When I explored the islands for *Partulæ*, I kept a daily journal and gave each species, when discovered, a provisional name, and kept the species from each valley separate. After I sold the collection to Mr. Pease I put up nine sets for him to send to London. He adopted nearly all my provisional names. Carpenter, Adams and Cuming compared the shells with those in the Cumingian collection, and the former published the result of their determinations in the Proc. Zoöl. Soc., 1864. I reserved a similar set for myself of all except five or six species of which there were no duplicates left after Pease made his selection for his cabinet. Ten years after my first explorations I went over the same localities a second time, so I certainly am pretty well posted on the Partulas of this group.

"Pease was very careless about localities, as any one can see by studying his papers. He was also careless about his duplicates, which he kept in cigar-boxes; and, as he once wrote me, his 'little daughter amused herself in arranging (?) his duplicates.' After his death, those who packed his collection to be sent to Boston must have made sad confusion by the admixture of species."

The last letter from Mr. Garrett is dated June 26, 1887, and in it he writes most bravely and touchingly of his own approaching death. "For some time I have been unable to work on my collection, which numbers over 8,000 species and 30,000 examples. It is hard to give them up and join the large majority. I am too weak to write much, so I will thank you over and over again for your kindness to me. I have made arrangements so that you will receive my three papers, now in the hands of the printers. I also hope, before the end comes, to receive yours on the Achatinellæ."

Mr. Garrett died of cancer, at Huaheine, Nov. 1, 1887. With the papers there is a sketch of his life with a list of his writings, by Rev. E. V. Cooper, of Huaheine, "communicated at the special request of Mr. Garrett before his decease."

XVIII. TWO NEW SPECIES OF BAHAMAN LEPIDOPTERA.

By W. J. Holland.

I am indebted to the kindness of Sir Gilbert T. Carter, the Governor of the Bahamas, for the pleasure of being permitted to describe the following species. It is sincerely to be hoped that His Excellency, who distinguished himself by his researches in the domain of natural history during his stay on the western coast of Africa may be able to find leisure in the midst of his pressing official duties to ascertain more than has heretofore been known in reference to the fauna of the interesting islands the administration of which is at present lodged in his most capable hands.

Class **INSECTA.**

Order **Lepidoptera.**

Suborder Rhopalocera.

Family **LEMONIIDÆ.**

Subfamily Erycininæ.

Genus **Charis** Hübner.

Charis carteri sp. nov.

♂. Antennæ two thirds as long as the costa, slender; club fusiform, black, tipped with white. Under a glass the antennæ are seen to be finely ringed with white. Front and eyes reddish-brown. Collar, upper side of thorax, and abdomen reddish. The segments of the abdomen on the upper side are annulated anteriorly with dark fuscous. On the under side the thorax and abdomen are grayish; legs concolorous. The ground color of the wings on the upper side is bright reddish-brown. There are three blackish transverse spots in the cell; one near the base, one about the middle, and one at the end, the one in the middle running obliquely in the direction of the outer angle. The spot near the base is continued in the form of a blackish band below the cell as far as vein 1. A blackish band runs from a little

behind the middle spot in the cell to vein 1. At the origin of vein 2, external to the cell, is a small round blackish spot. These markings are succeeded beyond the cell by a narrow and somewhat obscurely defined blackish line which runs from the costa as far as vein 4 in a straight line, and is then continued as far as vein 1, curving inwardly. This line is emphasized toward the costa by five small white spots lying external to it forming a series of minute white dashes. The external margin is obscurely clouded with fuscous, and between veins 1 and 2, near the outer margin, is an ill-defined blackish spot which reproduces on the upper surface the large and sharply defined black spot of the lower side. The fringes are fuscous.

The secondaries have the same prevalently reddish ground-color as the upper side. They are ornamented at the base by three or four blackish spots succeeded by a curved subbasal blackish transverse band which is irregular in outline and does not reach the inner margin. Beyond this subbasal band is a fine black band which curves outwardly about the middle and is continued from near the costa to vein 1. A broader blackish band obscurely defined both outwardly and inwardly succeeds this finer curved line. On its outer edge it is emphasized by an orange-red shade. At the anal angle is a large black ocellus surrounded by a pale orange-yellow annulus which is obsolete on the side of the outer angle of the wing. On this side the ocellus is marked by a very pale blue linear streak running parallel to the nervules. The outer angle of the wing is shaded with fuscous. The fringes are fuscous.

On the under side the wings are slaty gray. The markings of the upper side of the primaries are reproduced on the lower side, but are black and more prominent, especially the markings located near the inner margin between the cell and vein 1. These markings are accentuated by reason of the fact that the ground color in their immediate vicinity fades into pale creamy white. The series of white dashes on the upper side is reproduced on the lower side, but larger, and is continued across the wing as far as vein 1, the lower spot between veins 1 and 2 being diffuse and broad. There is a conspicuous black ocellus on the outer margin between veins 1 and 2. This ocellus is marked on its upper side by a pale white linear dash. The markings on the lower side of the secondaries are greatly reduced in size when compared with the upper side and consist of small blackish punctulations, indicating the course of the bands on the upper surface of the wing. The large ocellus which is so conspicuous on the upper side of the

secondaries is but feebly represented on the lower side by a patch of bluish-gray scales.

♀. The female is like the male, and only differs in having the upper surface of the wings somewhat grayer and not as bright reddish as is the case in the male insect. All the spots and markings are identical.

Expanse, 23 mm.

I am informed by Sir Gilbert Carter, in whose honor I name this insect, that it occurs very rarely on the island of Nassau and is extremely local in its habitat. The specimens which he sent me were taken on the 15th day of April of the present year. The species is unknown to English entomologists, and I have no hesitation in describing it as new to science. The types are with me at the Carnegie Museum.

Family **HESPERIIDÆ.**

Genus **Erycides** Hübner.

Erycides batabanoides sp. nov.

♂. Somewhat smaller in size than the smallest specimen of *E. batabano* (Lucas) contained in my collection. From *batabano*, its nearest ally, it may be distinguished by the fact that the anterior wings at the base are strongly marked with blue rays running parallel to the veins, and the secondaries are likewise marked by bright blue bands radiating from the base toward the outer margin. The submarginal blue band of the secondaries is also more strongly pronounced than is the corresponding band in *E. batabano*. The fold of the wing along the inner margin of the secondaries is accentuated by bluish-white hairs forming a conspicuous bluish-white band parallel to the inner margin. On the under side of the wing a corresponding difference exists. In *batabano* the markings of the secondaries consist, so far as I have observed in a large series of specimens, of a palish green submarginal streak before the anal angle. In *batabanoides* the primaries are strongly marked near the base by bright blue—not green. The secondaries are margined along the inner margin by a bright blue metallic line succeeded by another bright blue metallic line running from near the costa across the cell and along vein 2 toward the anal angle. This line is succeeded by another bright blue metallic band parallel to it, running from the costa as far as the origin of vein 3, and then curving inwardly and terminating on vein 1. Another metallic blue band rises on the

costa and runs, curving parallel to the outer margin, from the costa and coalesces at vein 2 with the line before mentioned.

It will be seen from this description that the secondaries are much more brilliantly decorated with bright blue bands than the species described by Lucas, and they may at a glance be differentiated from each other.

Expanse, 48 mm.

I have only one specimen, a male of this species, which Sir Gilbert Carter kindly sent me. He writes that the insect is rare in Nassau, but is reported to be common on Andros Island. Specimens referred to the authorities of the British Museum for study by Sir Gilbert were reported by them not to be known in that collection.

I am indebted to Sir Gilbert for a couple of good specimens of *Papilio bonhotei*, recently described by Miss Emily M. Sharpe, from the Bahamas. This is a subspecies of *Papilio andræmon* Hübner, and on comparison proves to be identical with specimens recently collected in southern Florida in the vicinity of Miami. *Papilio andræmon bonhotei* Sharpe, must be added to the list of species occurring within the limits of the United States.

XIX. ELOSAURUS PARVUS; A NEW GENUS AND SPECIES OF THE SAUROPODA.

By O. A. Peterson and C. W. Gilmore.

Associated with the large Brontosaur skeleton[1] (No. 563)[2] discovered last summer by the Paleontological Expedition of this museum operating from "Camp Carnegie," on Sheep Creek, Albany Co., Wyo., there was found the remains of a diminutive dinosaur hitherto unknown to science.

Through the kindness of Mr. J. B. Hatcher, Curator of the Department of Vertebrate Paleontology, the material has been placed in the hands of the writers for study and description.

The bones were found scattered over an area of some ten to fifteen feet square and as is the case with all disarticulated skeletons the association of parts is somewhat conjectural. In this instance, however, the association of this small dinosaur with the remains of the larger ¡ndividual, together with the particularly well preserved condition of the small bones makes it reasonably certain that they pertain to one animal. Moreover in the present instance doubtful bones have been excluded.

In the present paper a systematic description will be given of the material at hand and an attempt made to compare the most important characters with the better known members of this order.

The illustrations are from photographs by Mr. A. S. Coggeshall and drawings by Mr. Sidney Prentice.

We take this occasion to thank Mr. Hatcher for valuable suggestions and criticisms made in the preparation of this paper; Mr. F. A. Lucas for material loaned for comparison, and Prof. W. C. Knight for the use of literature.

[1] See Science, N. S., Vol. XIV, Dec. 27, 1901, p. 1015.

[2] The numbers enclosed in brackets refer to the Card Catalogue of Fossil Vertebrates in the collection of the Carnegie Museum.

Class **REPTILIA.**

Subclass DINOSAURIA.

Order **Sauropoda.**

Family **MOROSAURIDÆ.**

Genus **Elosaurus.**

Elosaurus gen. nov.

This genus may be distinguished from all the known Sauropoda by the pubis, which inferiorly is greatly expanded antero-posteriorly with a very prominent backward projection on the extreme posterior border of the distal end. The anterior cervicals have a single square node-like spine. The limb bones are solid.

Elosaurus parvus sp. nov.

The sacral vertebræ of this species are solid with the exception of three small pits extending down into the centra from their superior surfaces. The sacral rib attachments are very broad. The dorsals are comparatively low and massive with a large neural canal. The oblique position of the deltoid crest is characteristic. The proximal end of the ulna is greatly expanded posteriorly. The small size of this individual, together with the sutural articulations of the cervicals and dorsals to their centra, in all probability can not be considered of generic or specific importance, though we have thought best to mention them in this connection.

The type of this genus and species (No. 566) consists of the scapula, humerus, and ulna of the right forelimb and the humerus of the left, the right femur and left fibula of the posterior limbs. The pelvis is represented by the distal end of the right pubis, while part of a cervical and a complete arch of one of the dorsals together with two sacral centra and the proximal ends of three ribs is all that remains of the axial skeleton. The sacral centra, though found in close proximity to the other bones, have a worn appearance in comparison with the otherwise well-preserved material and will, for the present, only be provisionally referred to the type.

Scapula and Forelimb.—Though resembling Morosaurus in general outline the scapula is relatively longer and not so expanded superiorly, though the extent of this expansion cannot be determined accurately as a portion of the antero-superior border is missing. Medially the scapula is constricted. Distally it again expands into a wide plate for contact with the coracoid; externally this plate presents a concave surface terminating in a thin border anteriorly. This border increases in thick-

ness as it approaches the glenoid cavity. Anteriorly throughout its entire length the blade thins out to a sharp edge, while the posterior margin presents a thickened rounded border. There is no prominence on this border near the constriction, such as is found in many scapulæ of the larger Sauropods. Transversely the external surface of the blade

FIG. 1. External view of right scapula of *Elosaurus parvus* (No. 566), ¼ natural size. *S.*, spine.

is convex while the internal is somewhat concave. The spine is placed at right angles to the axis of the bone. The posterior border as it approaches the distal end curves backward abruptly, forming the superior border of the glenoid cavity. In the last two respects the scapula is identical with the typical Morosaurus scapula. The glenoid cavity as in the larger members of this order is formed by the union of the scapula and coracoid though the latter element is wanting in this specimen. See Fig. 1.

MEASUREMENTS.

Greatest length of scapula,	320 mm.	12½ inches.
Greatest breadth of scapula,	150 "	5⅞ "
Least breadth of scapula,	48 "	1⅞ "

Humerus.—The humerus is moderately stout and about two-thirds the length of the scapula. Proximally it is greatly expanded trans-

FIG. 2. Anterior view of right humerus of *Elosaurus parvus* (No. 566), ¼ natural size. *u.c.*, ulnar condyle; *r.c.*, radial condyle; *d.c.*, deltoid crest; *g.*, groove separating ulnar and radial condyles.

versely, and superiorly it presents a regularly convex surface, and a well-defined head for articulation with the scapula. The deltoid crest is prominent, but in both humeri it is turned obliquely outward thus forming much less of a concavity on the anterior surface, see Fig. 2, than is found in the humeri of other Sauropoda. Medially the shaft is constricted and a cross-section would be nearly circular. The ulnar condyle has a flat rugose surface while the internal or radial condyle is slightly concave, the two being separated by a well-defined groove on the anterior face. See *g*, Fig. 2.

MEASUREMENTS.

Greatest length of humerus,	225 mm.	$8\frac{3}{4}$ inches.
Greatest breadth of humerus, proximal end,	104 "	$4\frac{1}{16}$ "
Greatest breadth of humerus, distal end,	80 "	$3\frac{1}{8}$ "

Ulna.—The ulna as in the other Sauropoda is apparently the stouter element of the forearm. On the anterior side the proximal end has a well-defined groove in which the radius fits. See Fig. 3. On the distal internal side is a flattened, slightly rugose surface for the attachment of the radius, which element crosses from the front to the side of the ulna, as has been shown previously by Hatcher[3] and Riggs.[4] Laterally the proximal end is greatly expanded (see Fig. 3), but the ulna tapers down to a somewhat rounded distal extremity. The proximal end of the ulna supports the entire posterior and exterior portions of the humerus, thus enclosing externally and posteriorly the proximal end of the radius, while the radius articulates only with the internal or radial condyle.

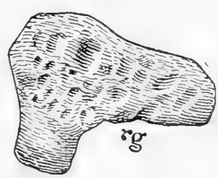


FIG. 3. Proximal end of right ulna of *Elosaurus parvus* (No. 566), one half natural size. *rg*, radial groove.

[3] Hatcher. Forelimb and Manus of Brontosaurus. Annals of the Carnegie Museum, Vol. I, pp. 356 et seq.

[4] Riggs. Foreleg and Pectoral Girdle of Morosaurus, Pub. Field Columbian Museum Geological Series, Vol. I, No. 10, p. 278.

MEASUREMENTS.

Greatest length of ulna,	162 mm.	6⅜ inches.
Greatest thickness of proximal end,	43 "	1⅝ "
Greatest breadth of proximal end,	56 "	2¼ "

Pelvis and Posterior Limbs.—The well-preserved distal portion of the right pubis is all that was recovered of the pelvis, and although it is generically the most characteristic bone preserved, because of its fragmentary condition, a complete description will have to be deferred until the discovery of more perfect material. If our determination be correct the enormous antero-posterior development of the distal end with the backward hook-like extension on the posterior border makes this element distinct from the pubis of any known Sauropod. The shaft was evidently short and broad. Immediately above the distal end the shaft is constricted but the postero-internal border above expands into a thin edge, which probably opposed a similar edge on

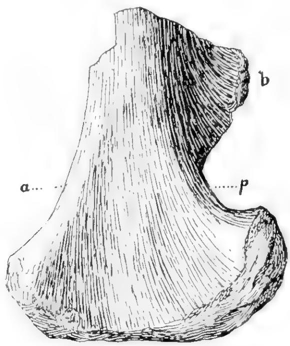


FIG. 4. Internal view of distal end of right pubis of *Elosaurus parvus* (No. 566), one-half natural size. *a*, anterior border; *p*, posterior border; *b*, supposed pubic articulation.

the opposite pubis. Anteriorly the shaft presents a thick rounded border. Externally the distal end is convex; internally slightly concave. The pubes were evidently united distally by a weak median symphysis. See Fig. 4.

MEASUREMENTS.

Greatest breadth of pubis, distal end,	79 mm.	3⅛ inches.
Greatest thickness of pubis, distal end,	27 "	$1\frac{1}{16}$ "

Femur.—This element is long and moderately robust with the two ends about evenly expanded. The shaft is compressed antero-pos-

teriorly with that diameter subequal throughout its length. The head of the femur is placed at right angles to the shaft of the bone, in which respect it most resembles the femur of *Diplodocus*.[5] The head is separated from the great trochanter by a slight constriction (see Fig. 5), but blends into the shaft without a well-defined neck.

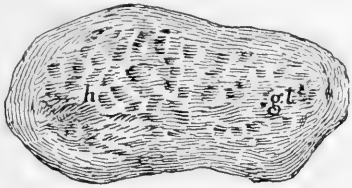


FIG. 5. Proximal end of right femur of *Elosaurus parvus* (No. 566), one-half natural size. *h*, head; *g.t.*, great trochanter.

The fourth[6] trochanter is very small, hardly more than a slight rugosity, placed on the internal margin on the upper half of the posterior side. Distally the femur expands, giving rise to the external and internal condyles, which are separated by a deep intercondylar groove. An external condylar groove divides the external condyle in two parts. See Fig. 6.

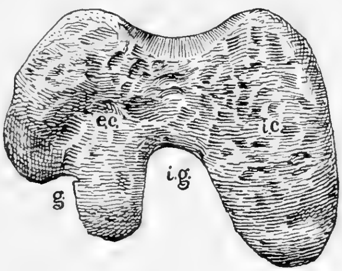


FIG. 6. Distal end of right femur of *Elosaurus parvus* (No. 566), one-half natural size. *e.c.*, external condyle; *i.c.*, internal condyle; *i.g.*, intercondylar groove; *g.*, groove which divides *e.c.* into two parts.

MEASUREMENTS.

Greatest length of femur,	335 mm.	13¼ inches.
Greatest breadth of femur, proximal end,	96 "	3¾ "
Greatest breadth of femur, distal end,	94 "	3⅝ "

Fibula.—The fibula is a long slender bone and presumably much lighter than the tibia. Transversely the diameter of the shaft remains

[5] Hatcher. Memoir of Carnegie Museum, Vol. I, No. 1, p. 47.

[6] Sometimes incorrectly called the third.

about the same throughout its length, but antero-posteriorly it is expanded more especially at the proximal end. The internal side of this end presents a triangular slightly concave rugose surface for attachment to the tibia. The antero-superior border is produced into a thin edge which fitted against the cnemial crest of the tibia. On the upper external half of the shaft is a slight rugosity which probably served as a muscular attachment. The lower extremity of the fibula is suboval in form and extended distally for articulation with the astragulus.

MEASUREMENTS.

Greatest length of the fibula,	243 mm.	9½ inches.
Greatest breadth proximal end,	56 "	2 3/16 "
Greatest breadth of distal end,	43 "	1⅝ "

AXIAL SKELETON.

The Cervicals.—The greater portion of an arch of one of the anterior cervicals is all that is preserved of the cervical series. In a general way it resembles the cervical arch of the larger members of this group. The arch was united to the centrum by a well-defined suture. The spine is low and robust, nearly square in cross-section and placed well back. The articulating surfaces of the posterior zygapophyses are expanded. Superiorly they are supported by the postzygapophysial[7] laminæ which descend from the adjacent posterior corner of the spine. These laminæ are strong superiorly but inferiorly form the rather frail posterior wall of the neural canal. There is a deep postzygapophysial cavity.[8] The prezygapophysial laminæ are very weak superiorly but more robust inferiorly, just the reverse of the postzygapophysial laminæ. The horizontal laminæ descend obliquely from the post- and prezygapophyses meeting in the diapophyses. The diapophysis or transverse process is low on the arch and extends downward, forward and outward, terminat-

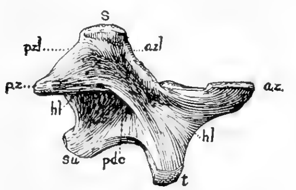


FIG. 7. Anterior cervical of *Elosaurus parvus*. Seen from the right side (No. 566), ½ natural size. *s.*, spine; *t.*, transverse process, or diapophysis; *a.z.*, anterior zygapophysis; *p.z.*, posterior zygapophysis; *azl.*, prezygapophysial lamina; *pzl.*, postzygaphysial lamina; *hl.*, horizontal lamina; *pdc.*, postdiapophysial cavity; *su.*, suture to centrum.

[7] We have used nomenclature for laminæ proposed by Dr. H. F. Osborn, see Memoir of Am. Museum of Natural History, Vol. I, part V, p. 193.

[8] Nomenclature for cavities was proposed by Mr. J. B. Hatcher, Memoir Carnegie Museum, Vol. I, No. 1, July, 1901, p. 17.

ing in a triangular end to which the cervical rib probably attached though there are no other evidences of the latter. This process is supported inferiorly by the inferior blade of the diapophysial lamina. The superior blade is absent. Of the diapophysial cavities the post- is the most pronounced, the pre- and supra- being very shallow, while the infradiapophysial cavity is wanting. See Fig. 7.

MEASUREMENTS.

Greatest length anterior to posterior zygapophyses,	60 mm.	2⅜ inches.
Top of spine to inferior border of neural arch,	35 "	1⅜ "

The Dorsals.—The presence of the heavy capitular facets situated far down on the anterior border of the neural arch, together with the presence of a single spine would indicate that this vertebra belonged well back in the dorsal series. The spine which wants the superior portion has a posterior position. The superior blades of the postzygapophysial laminæ are very heavy while the inferior are of weaker construction and descend to form the posterior walls of the neural canal. The transverse processes are well expanded and extend upward and forward as shown in Figs. 9 and 10. The tubercular facet is much restricted in comparison with the extended capitular articulation. The diapophyses are supported superiorly by very weak diapophysial laminæ; inferiorly these laminæ divide into two branches, one part descending obliquely backward to a point half way down on the neural arch, while the weaker branch[9] meets the heavy prezygapophysial laminæ just above the capitular facet, as is shown in Fig.

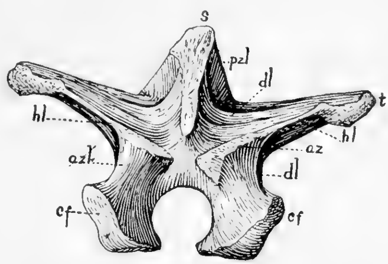


FIG. 8. Dorsal of *Elosaurus parvus.* Anterior view (No. 566), one half natural size. *s.*, spine; *azl.*, prezygapophysial lamina; *pzl.*, postzygapophysial lamina; *hl.*, horizontal lamina; *dl.*, diapophysial lamina; *t.*, transverse process; *a.z.*, anterior zygaphophysis; *c.f.*, capitular facet.

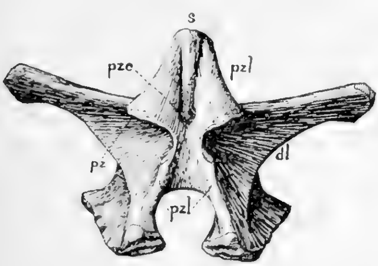


FIG. 9. Posterior view of same (No. 566). One half natural size. *p.z.*, posterior zygapophysis.

[9] If the complete dorsal series were known so that the development of the laminæ could be traced, this branch might prove to be a division of the horizontal laminæ as shown by Hatcher in his description of the dorsals of *Diplodocus.*

10. The horizontal laminæ extend almost horizontally from the pre- to the postzygapophyses meeting in the transverse processes. The inferior blades of the prezygapophysial laminæ are remarkably heavy, but the superior portion is wanting. The neural arch is comparatively large and nearly round. In general the arch has a low massive appearance like the transverse extension observed in Morosaurus. The arch was united to the centrum by a very coarse sutural articulation. Of the cavities all four of the diapophysial cavities are present, the pre- and post- being the most pronounced. The infrazygapophysial cavity is comparatively shallow. See Fig. 10.

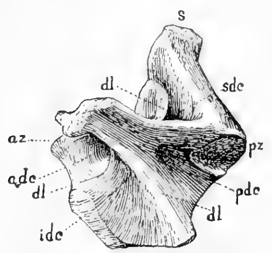


FIG. 10. Dorsal of *Elosaurus parvus*, seen from left side (No. 566), ½ natural size. *sdc.*, supradiapophysial cavity; *pdc.*, postdiapophysial cavity; *adc.*, prediapophysial cavity; *idc.*, infradiapophysial cavity.

MEASUREMENTS.

Greatest length from anterior to posterior zygapophyses,	57 mm.	$2\frac{3}{16}$ in.
Greatest expanse from end to end of transverse,	99 mm.	$3\frac{7}{8}$ in.

Sacrum.—The two sacral centra, which have been provisionally referred to this specimen are short, broad and comparatively solid, much resembling the sacral vertebræ of *Pleurocœlus nanus.*[10] Both ends of the centra are flat and there is no evidence of their having been coössified, though the absence of this character may be due to the young age of the individual. The attachments for the sacral ribs are very broad, extending over nearly the entire sides of the centra. Superior to the rib attachments are two pits extending down obliquely toward the center of the centrum. These pits are more pronounced on No. 1[11] than on No. 2. Inferiorly the neural canal at this point is enlarged by peculiar wedge-shaped pits which extend deep down into the centra. It is observed in both instances that the lateral dimensions are much greater than the longitudinal.

MEASUREMENTS.

	No. 1.		No. 2.	
Greatest length of centra,	72 mm.	$2\frac{7}{8}$ in.	68 mm.	$2\frac{5}{8}$ in.
Greatest width of centra,	88 mm.	$3\frac{1}{2}$ in.	98 mm.	$3\frac{7}{8}$ in.
Greatest depth of centra,	61 mm.	$2\frac{3}{8}$ in.	67 mm.	$2\frac{5}{8}$ in.

[10] Marsh, see American Journal of Science, Vol. XXXV.

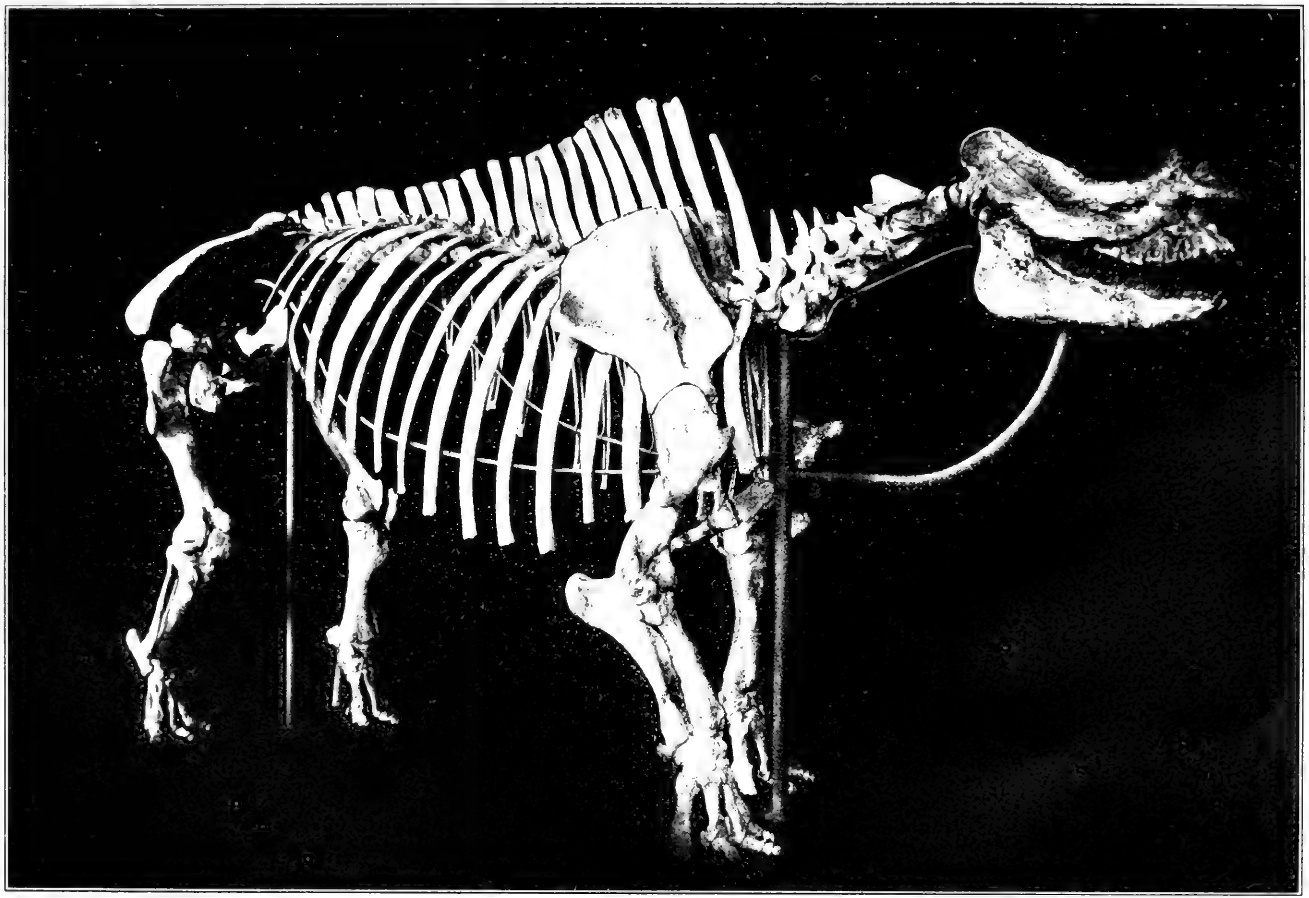
[11] These numbers are used to designate the vertebræ and have no reference to their position in the sacrum.

Summary.—Awaiting the discovery of a more complete skeleton of this genus, we have provisionally referred it to the family *Morosauridæ* because of the stout nature of the pubis; the similarity of the proximal portion of the scapula to the scapula of *Morosaurus*, and the comparatively solid condition of the sacral centra.

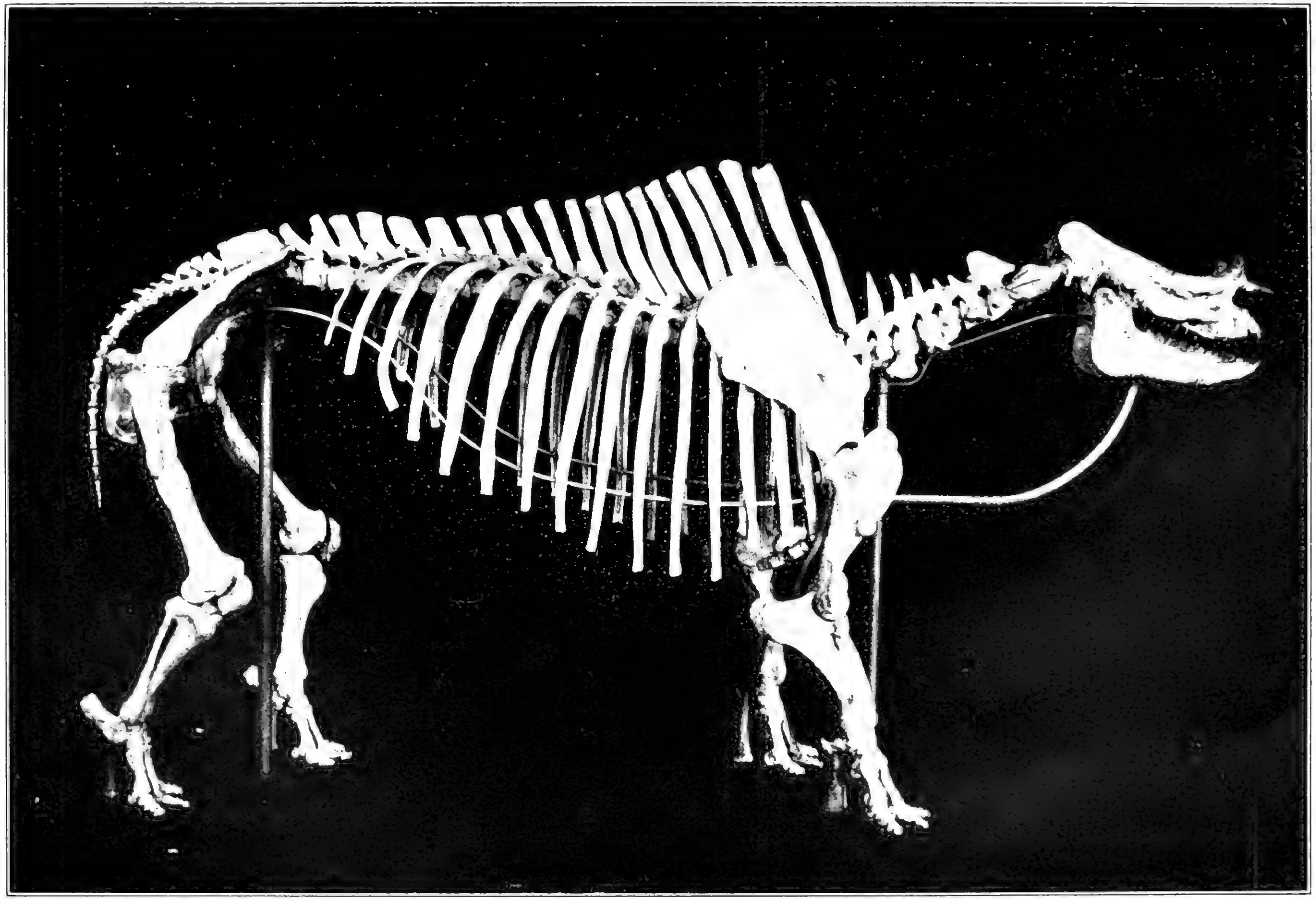
There is little to be said of the size of this animal, for, as has been already suggested, like most reptiles the Sauropoda probably continued to grow throughout their entire life. Though all parts of the osseous structure of this individual, which are preserved, are of comparatively dense bone, the immature age of the specimen cannot be questioned. The distinct neural sutures in the cervical and dorsal region, the separated sacrals, and the absence of the coracoid all indicate a comparatively young animal. By comparison of the fore and hind limbs (Plate XXV, Figs. 1 and 2) it will be observed that the fore limb is about two-thirds the length of the posterior, indicating a type whose movement on land was undoubtedly quadrupedal.

CARNEGIE MUSEUM,
May 1, 1902.

Femora of Titanotherium dispar Marsh (N...



Oblique front view of skeleton of *Titanotherium dispar* Marsh (No. 92) $\frac{1}{22}$ natural size



Side view of skeleton of Titanotherium dispar Marsh (No. 92) $\frac{1}{20}$ natural size.

Fore Arm and Manus of Brontosaurus.

Fore Arm and Manus of Brontosaurus.

fig. 1.

fig. 2.

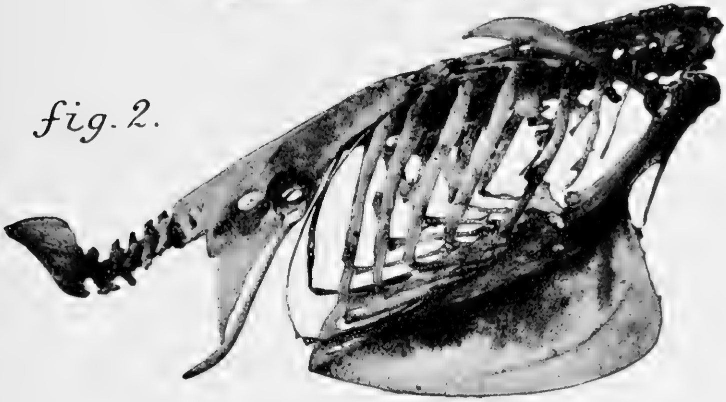


fig. 3.

Osteology of the Psittac·

fig. 4.

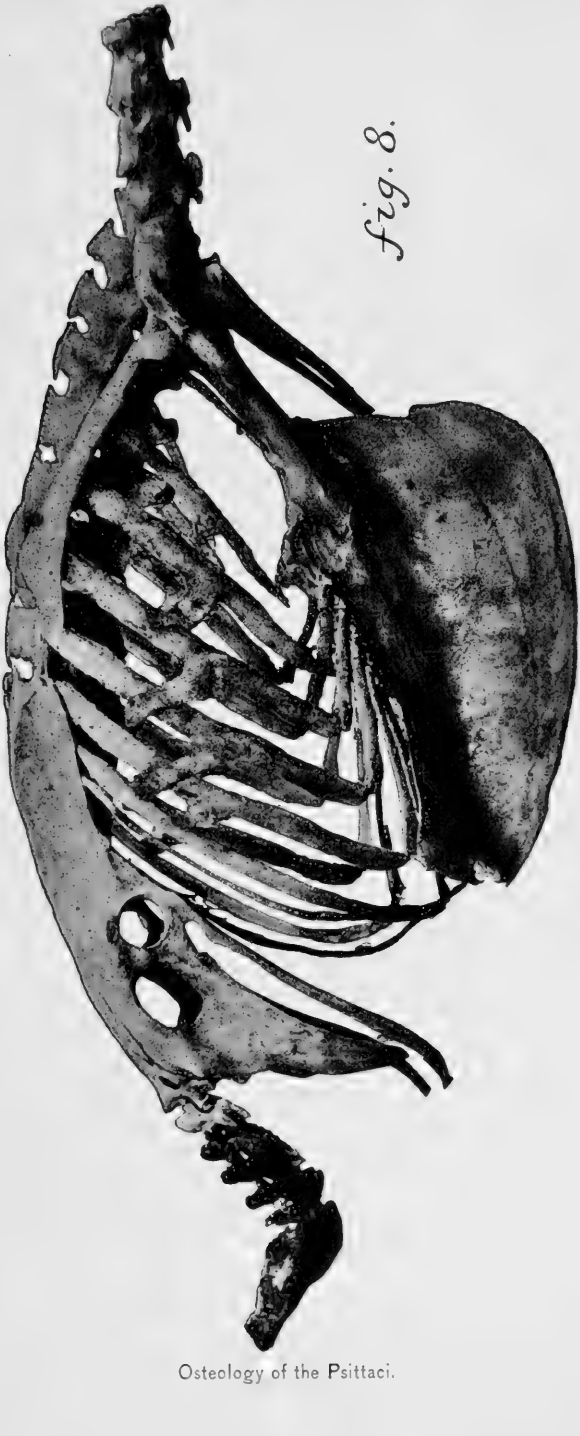
fig. 5.

fig. 6.

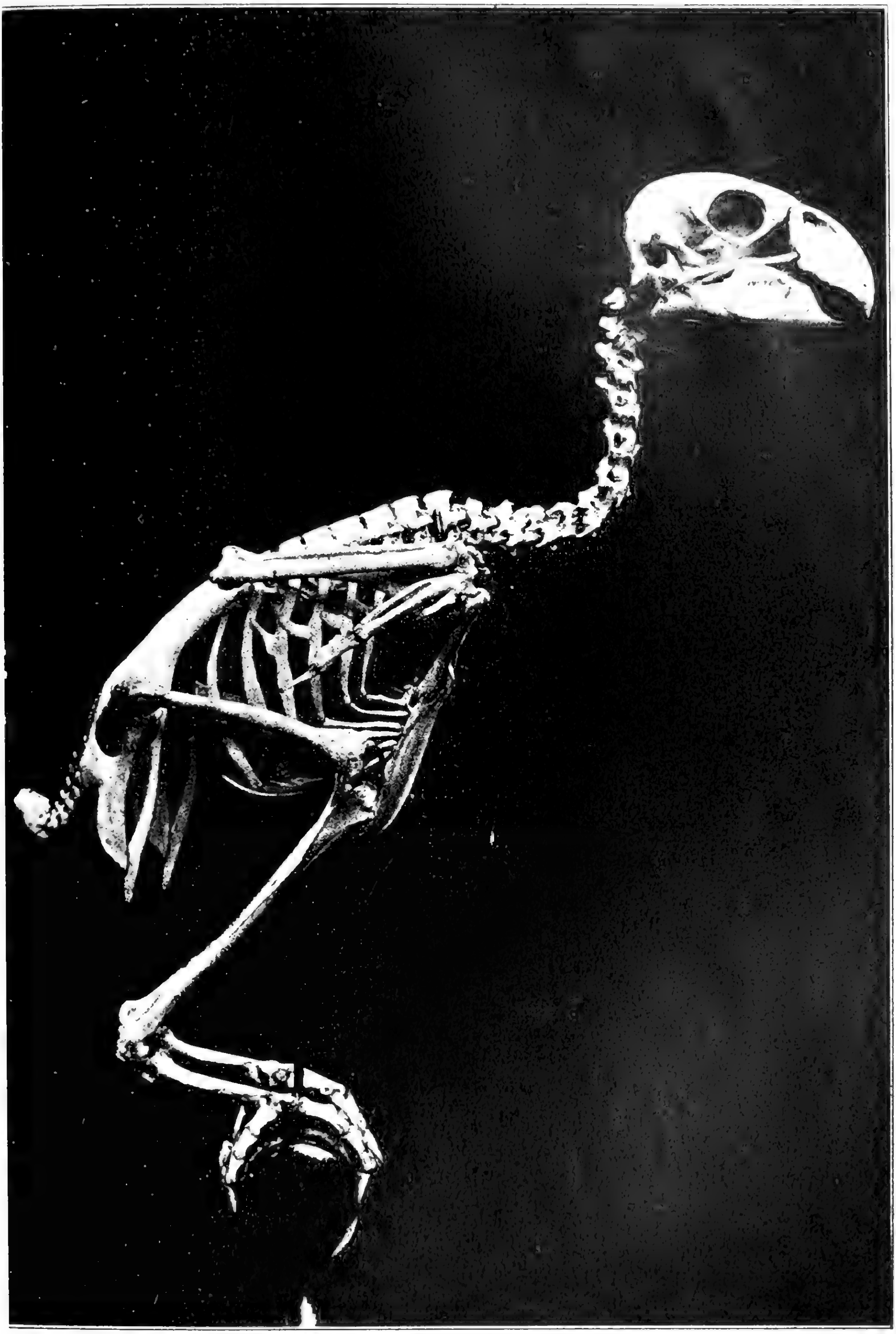
fig. 7.

Osteology of the Psittaci

fig. 8.



Osteology of the Psittaci.



Limbs of Elosaurus parvus

ANNALS

OF THE

CARNEGIE MUSEUM

VOLUME I. NO. 4.

EDITORIAL.

THIS number of the Annals of the Carnegie Museum brings to its end the first volume of this publication. Causes beyond the control of the editor have delayed the issue of the successive parts to some extent, but it is hoped that similar delays will not take place in the issue of the second volume, for which much valuable material is on hand, or in course of preparation.

The early days of the month of July were signalized at the Carnegie Museum by the presence of the American Association for the Advancement of Science and the Affiliated Societies. For the first time in the life of the city of Pittsburgh this great body of distinguished scientific laborers honored the municipality by their presence. They came as the guests of the citizens and of the Carnegie Institute. Generous provision was made for their entertainment by the hospitable people of the community, who donated for this purpose a fund of about nine thousand dollars. After paying all the expenses of the meeting there remains a balance of approximately two thousand dollars, which the kind donors have unanimously consented to allow to be applied to the acquisition of Egyptian collections for the Carnegie Museum.

The credit of making the necessary financial arrangements for the entertainment of the American Association in Pittsburgh is largely due to Mr. John B. Jackson, the Chairman and Treasurer of the Financial Committee. Mr. Emil Swensson, Mr. Thomas H. Johnson, Miss Julia Harding, Mr. C. R. Cunningham, Col. Samuel Moody, Rev.

Father P. A. McDermott, Mr. R. D. McGonnigle, Mr. W. N. Frew, Mr. James R. Macfarlane and Dr. G. W. Allyn, with their numerous and enthusiastic associates on the committees over which they presided, all did most efficient and successful work, and to them the editor desires to publicly return most hearty thanks for their invaluable coöperation in what proved in the event to be a large and somewhat difficult undertaking. While those who have been named deserve to be especially recognized, a review of the occasion would be incomplete without an acknowledgment of the invaluable services of Mr. George A. Wardlaw, the painstaking and the efficient local secretary, upon whom fell a heavy burden of correspondence and the arrangement of a multitude of minute details.

The kindness of Mrs. William Thaw in tendering a reception to the Association on the grounds of her beautiful residence, the action of the various patriotic associations among the ladies of the city in providing entertainment and comfort for the visiting ladies, and the hearty kindness with which the members of the Association were invited to enter and study the great manufacturing establishments of the city are thankfully remembered.

From the utterances of individuals and through the published accounts it is evident that the pleasure felt by those charged with the task of entertaining this great gathering was only equaled by the pleasure expressed by our guests. The editor of *Science* has editorially remarked that this was probably the most successful meeting of the Association which has been held within the last decade.

One of the most gratifying incidents in connection with the meeting was the election of Mr. George Westinghouse as an Honorary Fellow of the Association. This is the highest honor within the gift of the Association, which has been enjoyed by only a few men. It was eminently fitting that this honor should be conferred upon the illustrious Honorary President of the Local Committee, whose scientific researches in the field of mechanical science and in the application of scientific principles to industrial development have given him worldwide fame. Many persons think of Mr. Westinghouse solely as an eminently successful man of affairs, failing to realize that he is first and above everything else an investigator and student whose knowledge of physics and of mechanics as sciences is said by those who know him best to make him almost without a peer in this respect in the new world.

One of the most gratifying features of the occasion was the universal

recognition on the part of the assembled body of scientific men and women of the thoroughness and success of the work which is being done in that department of the Institute which stands for the advancement of science. A becoming modesty forbids us to quote the expressions which were publicly and privately heard, but the appreciation of what has been done in the Museum in the few years of its life, by men who are most competent to express a just judgment, was most gratifying and encouraging.

THE work that is being carried on by the department of paleontology is proceeding most successfully. Reports from the field indicate that the parties at work in Nebraska, Wyoming, and Montana will return to the Museum in the fall with as rich a booty as any of the expeditions which have gone out from the Museum during the last three years. Mr. W. H. Utterback is engaged in taking up a remarkably perfect specimen of Diplodocus. Enough has been uncovered thus far to lead Prof. Hatcher to think that the skeleton is very nearly complete. It is to be hoped that the skull may be found. The bones are reported by him to be in better condition than any which he has ever seen from the Jurassic deposits of Wyoming. Mr. Earl Douglass, to quote Prof. Hatcher, has "struck it rich." A large number of skulls and skeletons have been found. Similar reports come from the other camps.

MEMOIR No. II., upon the Oligocene Canidæ, from Prof. Hatcher's pen, accompanied by seven plates, and with numerous illustrations in the text, is in press.

THE ornithological collections belonging to the Museum are in process of rearrangement. It is hoped shortly to add to them a very large and perfect collection of the birds of the Netherlands, made by one of the most distinguished of living Dutch ornithologists.

MR. J. A. SHAFER has been spending some time at the Botanical Garden in Bronx Park, where, through the kindness of Dr. N. L. Britton, the Museum has been allowed to avail itself of the opportunity to obtain a large series of the duplicate specimens of the New York collection. The great kindness of Dr. Britton and his associates displayed toward the Carnegie Museum is sincerely appreciated.

MR. D. R. SUMSTINE has been systematically collecting the fungi of western Pennsylvania during the past summer. It is hoped ultimately to make our collection of these obscure vegetable forms completely representative of the region.

THE entomological collections of the Museum have received numerous accessions during the summer months. Mr. H. H. Smith and his wife having again forsaken the Museum, we understand for the purpose of taking up literature, steps have been taken to secure at once a custodian for this department. An announcement of the name of Mr. Smith's successor will be made in the next number of the ANNALS.

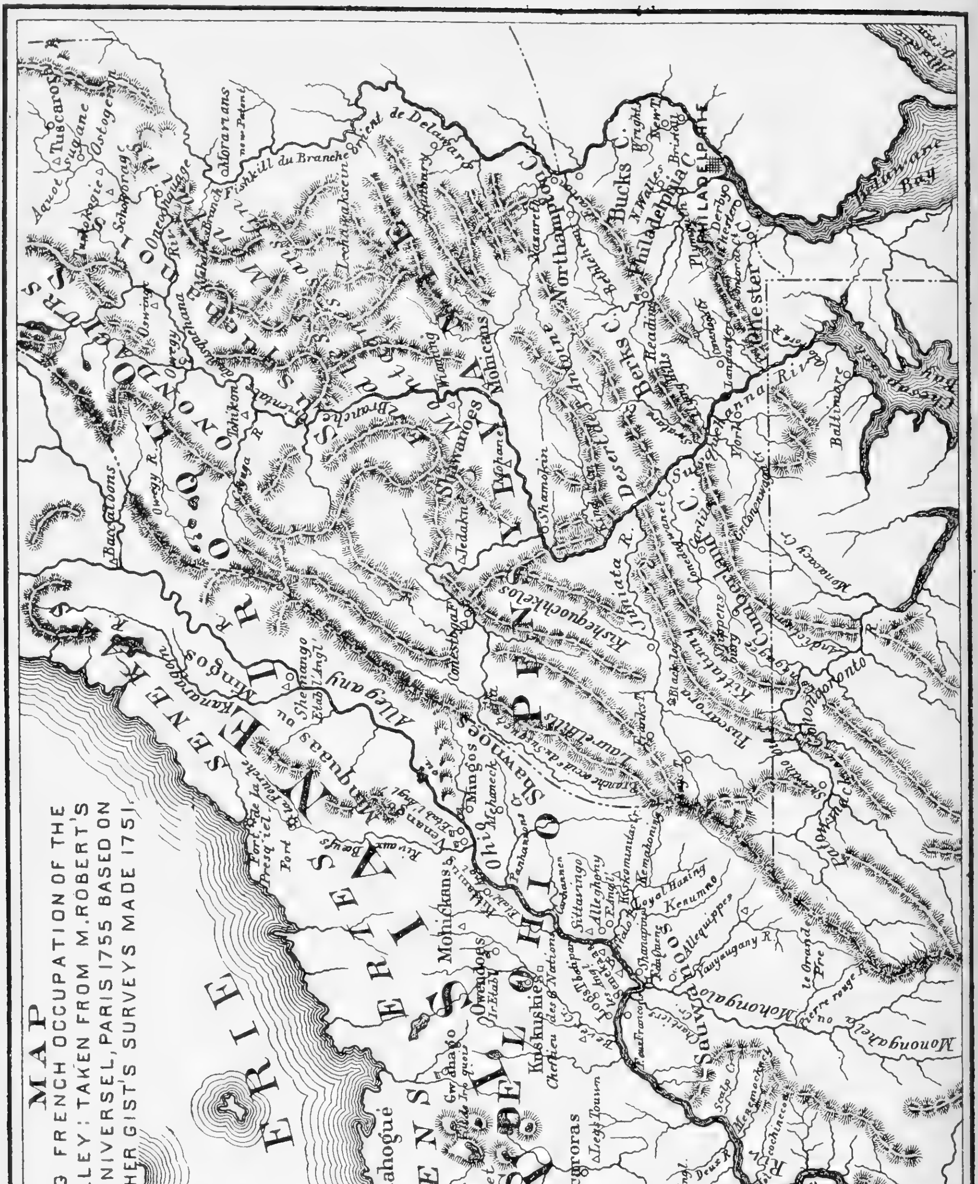
THE pelves of Brontosaurus, Diplodocus, and Morosaurus on exhibition in the Museum were greatly resorted to by the paleontologists at the meeting of the American Association for the Advancement of Science. These are the only complete pelves of their kind at present on exhibition anywhere. Prof. S. W. Williston, who discovered the first specimen of Diplodocus, and collected the type of the genus for Prof. Marsh, was led by the editor to the case containing this exhibit. He stood before it for a moment, and then gave a low whistle, and turning, said, "Well, this is wonderful! You have my best congratulations."

THE Lark Sparrow (*Chondestes grammacus* (Say)) in Beaver County, Pennsylvania.—On May 11, 1902, a pair of birds, positively identified as belonging to this species, were met with in a plowed field about five miles below the town of Beaver, near Oakwood station. One of them was collecting nesting material, indicating the proximity of a nest. Upon visiting the locality the following day I was fortunate in securing the male bird. This instance is, I believe, the first undoubted breeding record for the State of this species and illustrates the gradual eastward extension of its range.

W. E. CLYDE TODD.

A FOURTH specimen of *Putorius allegheniensis* Rhoads.—Mr. Gustav A. Link has kindly given me permission to announce that he has lately come into possession of a specimen of this rare Weasel, taken at Herman, Butler County, Pennsylvania, on July 11, 1901. The animal is in full summer pelage and agrees with the other known specimens of the species in all essential characters.

W. E. CLYDE TODD.



MAP
SHOWING FRENCH OCCUPATION OF THE OHIO VALLEY: TAKEN FROM M. ROBERT'S ATLAS UNIVERSEL, PARIS 1755 BASED ON CHRISTOPHER GIST'S SURVEYS MADE 1751.

XX. THE BOUNDARY CONTROVERSY BETWEEN PENNSYLVANIA AND VIRGINIA; 1748–1785.

A SKETCH,[1] BY BOYD CRUMRINE, OF WASHINGTON, PA.

It is proposed to publish in the ANNALS of the Carnegie Museum, the original minute books of the old Virginia Courts held within the limits of southwestern Pennsylvania, during the period when Virginia claimed and exercised jurisdiction over what is now Washington, Greene, Fayette, Westmoreland, and Allegheny Counties, Pennsylvania, and it is fit that these minutes should be preceded with a sketch of the boundary controversy between the two states, beginning as early as 1748, and terminating only by the final establishment of the western boundary line as it is to-day in 1785.

When this contest began our Western country was indeed a wilderness. Thomas Hutchins, an engineer with Bouquet's expedition in 1764, said of it in his "Topographical Description of Virginia, Pennsylvania, and Maryland," published in London in 1778: "The whole country abounds in Bears, Elks, Buffaloes, Deer, Turkies, etc., an unquestionable proof of the goodness of its Soil." In a foot-note, Hutchins quotes from Gordon, a still earlier explorer: "This country may, from a proper knowledge, be affirmed to be the most healthy, the most pleasant, the most commodious, and the most fertile spot of earth, known to European people." Francis Parkman, writing of the country west of the Alleghanies in 1760, says: "One vast and continuous forest shadowed the fertile soul, covering the lands as the grass covers a garden lawn, sweeping over hill and hollow in endless undulation, burying mountains in verdure, and mantling brooks and rivers from the light of day:"[2] Thus, more than a century ago, when our country was a wilderness, did it give promise of its future greatness.

[1] This sketch is founded upon an address delivered before the Western Pennsylvania Historical Society, in Allegheny City, in the spring of 1894.

[2] Conspiracy of Pontiac, 147.

THE FRENCH OCCUPATION.

But, before proceeding to discuss the special subject of this sketch, it should be noticed that, as the custom of nations with reference to new discoveries by their peoples went, the country west of the Alleghanies, prior to its actual occupation and settlement by Englishmen, was in the occupation and jurisdiction more or less rightful of France, known as the French Occupation; so that, had there not been a change of jurisdiction, we might have been a French people.

At one time in American history France claimed all the lands west of the Alleghanies by right of prior discovery; and the establishment of her power on the coasts of North America was coeval with the first colonies from England.[3] In 1682, the year in which William Penn first came to his new colony on the Delaware, Robert Cavalier, Sieur de la Salle, having passed with his expedition from the lakes into the Mississippi, proceeded in April to the mouth of that river, and in the name of Louis XIV. took possession of all the lands watered by the Mississippi and its tributaries, and named the country Louisiana.[4] In the library of Washington & Jefferson College is a very rare and valuable atlas, entitled "Atlas Universel," etc., published at Pàris in 1755. The ninety-eighth map of the series shows a part of North America, embracing the course of the Ohio River, New England, New York, New Jersey, Pennsylvania, Maryland, Virginia, and Carolina. It represents the boundary line between Pennsylvania and Louisiana as being the most western ridge of the Alleghany mountains.

The map mentioned, purporting to have been based upon surveys made by Christopher Gist in 1751, is the oldest map of western Pennsylvania the writer has seen. On it is indicated "F. du Quesne," at the mouth of the "Monongahela ou Mohongalo." The river below Fort Duquesne is called the "Ohio ou Splawacipika"; above the fort it is called "Ohio ou Allegany." Several Indian villages are designated, and two English towns, or settlements, Kittanning and Venango. Lake Chatauqua is indicated, but without a name. It was called in early historical writings, "Jadague."

But there was an older map extant; for, at a meeting of the Provincial Council on August 4, 1731, there was produced a "Map of Louisiana, as inserted in a Book called a New General Atlas, published at London in the year 1721," when it was first observed how "exor-

[3] I. Bancroft, 17, 18. [4] II. Bancroft, 338.

bitant the French claims were on the Continent of America; that by the description in said Map they claimed a great part of Carolina and Virginia, and laid down the Susquehanna as a Boundary of Pennsylvania." It was also noted that, by the information of Indian traders west of the Alleghanies, the French were endeavoring to "gain over" the Indians to their interests.

Pennsylvania was thus warned as early as 1731 that a powerful continental nation, with which her parent kingdom was at peace, was threatening a foothold upon fertile lands within her own charter limits, undefined however until a later date. Disturbed for many years by a controversy with Lord Baltimore concerning her southern boundary, and also by disagreements between the proprietary Governors and Provincial Assemblies, as well as by continuously embarrassing relations as to her Indian affairs in her undoubted possessions and settlements east of the mountains, for many years she made no effort to repel the French intrusion. Not until Virginia, in 1748 and 1749, had taken the initiative in the establishment of the Ohio Company in the vicinity of the Pittsburgh of to-day, did Pennsylvania manifest an interest in the subject. Where her western boundary might lie she seemed to know little and care less. It was the Virginian occupation in the years mentioned, resulting in the French and Indian war, which brought to Pennsylvania a suggestion of watchfulness as to her western boundary.[5]

In 1748, Thomas Lee, of the King's Council in Virginia, formed the design of effecting settlements on the wild lands west of the Alleghanies, through the agency of a land corporation called the Ohio Company. Lawrence Washington and Augustine Washington, elder brothers of George Washington, were interested in the scheme. A grant was obtained from the English king of five hundred thousand acres of land, to be taken chiefly on the south side of the Ohio, between the Monongahela and Kanawha rivers. Two hundred thousand acres were to be selected immediately, and to be held for ten years free from quit-rents and taxes, on condition that the company should seat one hundred families on the lands within seven years, and build a fort and maintain a garrison sufficient to protect the settlements.

In 1751, Christopher Gist was sent out from Virginia as the agent of the Ohio company to explore the lands, and it was then doubtless

[5] Crumrine's History of Washington County, p. 140.

that he made the surveys, which, being published, formed the basis of the French map of 1757. In 1752, with Joshua Fry and two other commissioners representing Virginia, Mr. Gist attended a treaty with the Indians, with whom the French were tampering. This treaty was held at Logstown, eighteen miles or so below Pittsburgh, on the Ohio. Some years ago there was quite a discussion in the newspapers as to the location of Logstown, whether it was on the north or on the south side of the river. In fact there were two Logstowns, opposite each other; one on the north bank, occupied by white or half-breed traders, and the other on the south bank occupied by the Shawanese Indians.

It is manifest that one of the principal objects of the Ohio Company was to meet the French claim and occupation of lands upon the Ohio and Alleghany by actual settlements to be made by English colonists from Virginia. The headquarters of Leguardeur de St. Pierre, the French commandant, were at Venango; and in 1753, Governor Dinwiddie, then also one of the proprietors of the Ohio Company, sent George Washington, a youth of twenty-one years, to the French commandant, to ascertain the purpose of the threatened encroachment. It was on this journey that Washington stood on the "Point" at the confluence of our two rivers, which he reported in his Journal, as an eligible place for a fort.[6] In 1754, the erection of a fort at the place indicated was begun by Capt. William Trent in command of a body of Virginia militia. After its commencement, Captain Trent returned to Will's Creek (now Cumberland) leaving the construction of the fort to Ensign Edward Ward; but on April 17, 1754, a hostile force of about seven hundred French and Indians came down the Alleghany under the command of Capt. Contrecour, to whom Ensign Ward[7] with but thirty-three men, surrendered the unfinished fort. The fort was then completed by the French and named Fort DuQuesne, in honor of the Marquis DuQuesne, the French Governor General of Canada.

Thus were the French in the actual military occupation of the valley of the Ohio. Then followed the events of the so-called French and Indian war: the battle of Fort Necessity, at Great Meadows in what is now Fayette county, Washington's maiden engagement; and the surrender of the fort to the French on July 4, 1754; in the next year the battle of Braddock's Defeat, on July 9, 1755, resulting in the complete expulsion of the English from the waters of the Monon-

[6] The Olden Time, Vol. I., p. 12.

[7] Afterwards one of the Justices of the old Virginia Courts.

gahela and Ohio. All this contest between the French and Indians on the one side, and the English on the other, was brought about without the agency of Pennsylvania.

There followed a state of quiesence on the part of the French, themselves apparently satisfied with the fact of their possession ; but not so was the state of the Indians. Secretly incited by the French, doubtless, the Indians carried their bloody incursions into the valleys east of the mountains, leaving desolation, death, and suffering on every side. But, in 1756, occurred the expedition of Col. James Armstrong from Fort Shirley, in what is now Huntingdon county, resulting in the destruction of the Indian towns at Kittanning ; in 1758, Forbes's expedition, with Grant's defeat on Grant's Hill, Pittsburgh, on September 14, followed by the capture or rather the abandonment of Fort Duquesne on November 25th, and the erection of Fort Pitt (though not in the same location as Fort Duquesne), in 1759, by a force under the command of Gen. Stanwix.

It must be remembered that this expulsion of the French from the Ohio valley was not by the militia alone of either Pennsylvania or Virginia, but by royal forces sent over by the English government, aided by the militia from both colonies. And so the French occupation was terminated by the definitive treaty of peace between England and France, signed on February 10, 1763, and then passed from France all her possessions in America east of the Mississippi, including Canada.

THE VIRGINIA OCCUPATION.

The erection of the fort at the Point by Capt. Trent, in 1754, a trespass by Virginia upon the lands in the valley of Ohio, brought about the French and Indian war, resulting beneficially, however, in the loss to France of most of her American possessions and their acquisition by the English, and bringing directly to Pennsylvania a sharpened sense of the necessity for looking after her political interests west of the Alleghanies.

Now, what was the origin of this Virginia usurpation, for usurpation it was? How did it happen that Virginia claimed any of her territory within our western border? How did she come to claim jurisdiction over the great Northwestern Territory, the mother of magnificent states of the Union? The answers to these queries arise out of the following facts :

The charter granted by Charles II. to William Penn, for the province of Pennsylvania, was dated March 4, 1681. The grant was bounded on the east by the Delaware River, "unto the three and fortieth degree of Northern latitude, if the said river doth extend so far northward; . . . The said land to extend westward five degrees in longitude to be computed from the said eastern bounds; and the said lands to be bounded on the north by the beginning of the three and fortieth degree of northern latitude, and on the south by a circle drawn at twelve miles distance from New Castle northward and westward, unto the beginning of the fortieth degree of northern latitude, and then by a staight line westward to the limits of longitude above mentioned."

It thus is made plain, that Pennsylvania was a province of three degrees of latitude and five degrees of longitude, extending from the fortieth degree, *i. e.*, line 39°, to the beginning of the forty-third degree, *i. e.*, line 42°; and in the absence of an interference with any prior grant, doubtless no other position would ever have been entertained. But in 1632, forty-nine years before Penn's charter, Charles I. had granted a province to Lord Baltimore, named Maryland, under the terms of which charter a very interesting controversy arose between Penn and Lord Baltimore, whether Penn's charter carried him to the parallel 39°, as he claimed it did, or only to parallel 40°, as claimed by Lord Baltimore. But it was destined that our southern border should be neither at parallel 39°, nor at parallel 40°; although many were the contentions and strifes among settlers along the Maryland line, arising before this controversy was determined by the running of Mason and Dixon's line at 30°, 43′, 26″, in 1767, to a point two hundred and forty-four miles from the river Delaware, and within thirty-six miles of the whole distance to be run. This point was at the second crossing of Dunkard Creek, near the southern boundary of Greene county; and by that point passed the Warrior Branch of the old Catawba or Cherokee trail, along which traveled the war parties of the northern and southern Indians. Across it the Indian escort of the surveying party would not allow even an imaginary line to be drawn. Thus, at the beginning of 1768 the southwest corner of Pennsylvania had not been found and marked, and the western boundary, whether an irregular line or a meridian, was as yet unknown.

But how the controversy with Virginia came about has not yet appeared. For this we must go back to the Virginia charter, which antedated both that of Maryland and that of Pennsylvania.

The first charter or patent for the colony of Virginia was by Queen Elizabeth in 1583, and it had neither name nor bounds. The settlers under this patent, partly from misconduct and partly from the opposition of the Indians, and other calamities, abandoned their efforts and the patent became extinct. But in 1602 James I. succeeded Elizabeth, and in 1606 he issued a new patent incorporating two companies, called the South Virginia Company, and the North Virginia Company, afterwards called respectively the London Company and the Plymouth Company. Each was to be limited to a square of one hundred miles backward from the sea. The London Company, with which we are concerned, settled at Cape Henry, and hence the square of one hundred miles granted by that patent could not have extended to the eastern base of the Blue Ridge. But in 1609, the London Company received a new patent, with the boundaries of their grant enlarged by the following terms:

"All those lands . . . lying and being in that part of America called Virginia, from the point of land called Cape or Point Comfort, all along the sea-coast to the northward two hundred miles; and from the said Point or Cape Comfort all along the sea-coast to the southward two hundred miles; and all that space and circuit of lands lying from the sea-coast of the precinct aforesaid up into the land throughout, from sea to sea, west and northwest."

Observe the ambiguities in the terms of this grant, the chief of which is in the words "up into the land throughout, from sea to sea, west and northwest," as containing directions for the northern and southern boundaries. Shall the due west line be drawn from a point on the sea-coast two hundred miles north of Point Comfort, and the northwest line be drawn from a point on the sea-coast two hundred miles south of Point Comfort? If so, then the London Company was limited to a triangle which extended to no territory in our western border. Or, shall the west line be drawn from a point on the sea-coast two hundred miles south of Point Comfort, and the northwest line from a point on the sea-coast two hundred miles north of Point Comfort? This was the interpretation claimed by Virginia, and one will see that if it were correct, the northwest line would run through the heart of Pennsylvania, passing east out of Erie City; while, the southern boundary line, running due west, the two would never meet, and Virginia would have owned the greater part of the entire continent. But, without discussing further the propriety of either interpretation,

let it be said that Virginia always, while yet a colony and after she became a state, referred chiefly to this charter of 1609 as authorizing her jurisdiction. not only over the Monongahela and Ohio valleys, but also as giving her an ownership over the entire Northwestern Territory.

This jurisdiction over the territory northwest of the Ohio River, Virginia refused to cede to the Confederacy of the United States, though her refusal endangered the confederation, until in 1781, when, no longer able to resist the influence of the other states, especially that of Maryland, she finally gave way so far as to abandon her claims over lands north and west of the Ohio River, on condition, however, that the United States would guarantee her rights to the south and east of the Ohio. This guaranty the Congress of the United States refused, and in 1784 the condition was withdrawn and the cession made absolute. But it is interesting to note that no sister state or government, nor the Congress of the Confederation, ever at any time recognized the right of Virginia to such jurisdiction. Only for the sake of perfecting the Union, such as it then was, was there any respect at all paid to her pretensions.

But, assuming that Virginia's interpretation of her charter provisions was the correct one, there was another fact which wholly ousted her claim to any lands which might eventually be found to fall within the boundaries of Penn's charter. In 1624, prior to the grant of Maryland to Lord Baltimore, as well as prior to the grant of Pennsylvania to William Penn, the charter to the London Company was dissolved in the English courts by a writ of quo warranto; and from a proprietary colony somewhat like that of Pennsylvania, Virginia from that time on was a Crown colony. The distinction between a colony and a province, such as was Pennsylvania, is well known. Whatever rights are secured to the proprietor of a province cannot be infringed or altered by the Crown, without the consent of the proprietor, nor abrogated unless by judgment of law founded upon some act of commission or omission working a forfeiture or dissolution. But a royal or crown colony is a mere creature of the royal will; its boundaries, all its machinery of government, may be modified, altered, or annulled at the royal pleasure and discretion. For this reason alone, therefore, Virginia having become a crown colony prior to the passing of Penn's charter, she could thereafter make no claim to any lands within the limits of Penn's charter, whatever interpretation was to be put upon the terms of her own charter provisions.

To explain the origin of Virginia's usurpation of territory upon the Monongahela and Ohio, the writer digressed from the building of Fort Pitt, near the mouth of the Monongahela, in 1759, followed by the cession of the French claims by the treaty of 1763. Soon after that treaty occurred what is known as the Conspiracy of Pontiac, in the summer of 1763. This was an effort set on foot in 1762, at Detroit, by that great chieftain Pontiac, who organized all the Indian tribes under a common purpose to drive the hated English entirely out of the country. It is said that, to raise means to supply his forces in their incursions eastward he issued promissory notes on birch bark, signed with the figure of an otter, and that, moreover, they were all subsequently redeemed by him. In the spring of 1763 Pontiac appeared with his savage forces in the neighborhood of Fort Pitt, moved across the mountains, and almost desolated the settlements on the east, even through the valley of the Susquehanna. During this Indian war, terminated by Bouquet's expedition, and the desperate battle of Bushy Run, on Turtle Creek, in Westmoreland county, on August 5, 1763, and the relief of Fort Pitt thereby, there was no opportunity for an immediate conflict of civil jurisdiction west of the Alleghanies. From 1764 to 1774, however, there was peace with the tribes, the pioneers being disturbed only at times by the occasional depredations of savages intent upon plunder rather than moved by the havoc of war. And George Washington, then a colonel, turned his attention to the acquisition of lands west of the mountains. In 1770, on October 17th, with Dr. Craik, who had been his companion in arms at the battle of Great Meadows and in Braddock's defeat, he arrived at Fort Pitt, and in his journal[8] he mentions his meeting at Semple's tavern, where he stopped, Dr. John Connolly, "nephew to Col. Croghan, a very sensible and intelligent man, who had traveled over a good deal of this western country, both by land and water." This Dr. John Connolly, thus introduced to us by no less a personage than Col. George Washington, was soon to play an important part in the civil history of the country west of the mountains; for he became the leader of the Virginia adherents in the contest to establish the Virginia jurisdiction along our rivers, and, as will be seen, a justice of one of her courts.

In 1772, John Murray, the fourth Earl of Dunmore, one of the Peers of Scotland, became Governor of Virginia; and early in 1773 he made a visit to Fort Pitt, where he met Dr. John Connolly, hereto-

[8] Olden Time, Vol. I., p. 416.

fore introduced to us by Col. Washington, who had dined with him at Semple's. Most probably Lord Dunmore, who was an intense loyalist, had early information of transactions presaging the rupture of the colonies from the mother country, and in the controversy instituted over the boundary question, as well as in his management of the Indian war of 1774, known as Dunmore's war, he was impelled in both to put the two colonies of Pennsylvania and Virginia in antagonism to each other. And it must be remembered that on February 26, 1773, Westmoreland county had been erected, covering all the territory of southwestern Pennsylvania, and the seat of justice was placed at Hanna's Town, about four miles from the present Greensburg. The establishment of government and courts of justice over this territory necessitated increased taxation upon the lands of the pioneers; and, as the greater number of them had come over the mountains from Maryland and Virginia, by way of Braddock's road, it was not a matter of very great difficulty to equal the number of patriotic Pennsylvanians by the number of Virginian partisans from our own settlers. It may be noted that Capt. William Crawford, he who was burned at the stake by the Indians at Sandusky in July, 1782, was a Pennsylvanian, being one of the justices of the peace, and justices of the county of Bedford, when first organized in 1771; but he afterwards espoused the cause of Virginia in the boundary controversy, and in 1775, when presiding judge of the Westmoreland county court, his judicial office was taken from him, as he had then accepted the appointment of justice under Lord Dunmore.

On January 1, 1774, Dr. John Connolly had posted a printed advertisement at Pittsburgh, and throughout the vicinity, announcing that Lord Dunmore, Governor of Virginia, had been pleased to nominate and appoint him "Captain, Commandant of the Militia of Pittsburgh and its Dependencies," and proposed "moving to the House of Burgesses the necessity of erecting a New County, to include Pittsburgh;" a Virginia county, of course. This official announcement created some consternation among the good people of the Pennsylvania jurisdiction. Arthur St. Clair, prothonotary of Westmoreland county, caused Dr. Connolly to be arrested, but the prisoner, after a few days confinement in the county jail at Hanna's Town, prevailed upon the sheriff to permit him to visit Pittsburgh, pledging his honor to return before the next court in April. He did return, but in a manner entirely unexpected. He returned with from one hundred and fifty to

one hundred and eighty men, "with their colors flying, and Captains, &c., had their swords drawn." "The first thing they did was to place sentinels at the court-house door, and then Connolly sent a message that he would wait on the magistrates and communicate the reasons of his appearance:" so says the letter of Thomas Smith to Governor Penn, dated April 7, 1774. Connolly explained his appearance, saying among other things, "My orders from the Government of Virginia not being explicit, I have raised the Militia to support the Civil Authority of that Colony vested in me." The Pennsylvania Court at Hanna's Town rose the next day, April 8th, and Æneas Mackay, Devereux Smith, and Andrew McFarlane, three of the justices residing at Pittsburgh, returned to their homes at that place; and the next day, April 9th, all three were arrested upon the order of Dr. Connolly and sent under guard to Staunton jail, in the valley of old Virginia. Arriving at Williamsburg the prisoners met Lord Dunmore, who heard their story and told them "that Connolly was authorized by him as Governor of Virginia to prosecute the claim of that Colony to Pittsburgh and its Dependencies; and, as to taking of prisoners, he Connolly, only imitated the Pennsylvania officers in Respect to Connolly's imprisonment by them." Dunmore, moreover, released them, and permitted them to return to their homes.

Then followed a series of arrests and counter-arrests, long continued, resulting in riots and broils of intense passion. Every one who, under color of an office held under the laws of Pennsylvania, attempted any official act, was likely to be arrested and jailed by persons claiming to hold office under the government of Virginia. Likewise were Virginia officials liable to arrest and imprisonment by the Pennsylvania partisans.

It is impossible to go into any detail in narrating special instances of these extraordinary commotions among the pioneers of a wilderness, all of them occupying homes of rude construction, their roof-trees and firesides all the time to be guarded from the incursions of their savage Indian foes. This condition of things must be remembered in thinking of these scenes; and an illustration of the state of the times among our white fathers themselves may be found in extracts from a letter dated August 4, 1771, a little prior to the assumptions of John Connolly, written by George Wilson, residing on the Monongahela near the mouth of George's Creek, in what is now Fayette County. George Wilson was then one of the justices of the courts of Bedford county, which had been organized early in 1771; and was the great-grand-

father of Hon. W. G. Hawkins, now one of the judges of the Orphans' Court of Allegheny county. That letter is a "quaint and curious volume of forgotten lore." The writer, stating that he had just returned home from court, relates that he found a paper being circulated among his neighbors pledging the subscribers to oppose "Every of Pen's Laws, as they called them, except felonious actions, at ye risk of Life & under ye penalty of fiftey pounds, to be Received or Leveyed By themselves off ye Estates of ye failure. The first of them I found hardy anuff to offer it in publick, I emediately ordered into Custody, on which a large number Ware assembled as Was supposed to Resque the Prisonar. . . . When their Forman saw that the Arms of his Contrie, that as he said He had thrown Himself into, would not Resque him By force, hee catched up his Rifle, Which Was Well loaded, jumped out of Dors & swore if any man Cam nigh him he would put what Was in his throo them. The Person that Had him in Custody Called for assistance in ye King's name, and in particular Commanded myself. I told him I was a Subject, & was not fit to Command if not willing to obey; on which I watched his eye until I saw a chance, Sprang in on him & Seized the Rifle by ye Muzzle, and held him So as he Could not Shoot me, until more help Gott in to my assistance, on which I Disarmed him & Broke his Rifle to peses. I Res'd a Sore Bruse on one of my arms By a punch of ye Gun in ye struggle; Then put him under a Strong Guard, Told them the laws of their Contrie was stronger than the Hardest Ruffin among them. I found it necessary on their Complyance & altering their Resolves, and his promising to Give himself no more trouble in the affair, as hee found that the people Ware not as hardy as hee Expected them to be, to Relece him on his promise of Good Be-haviour."

Correspondence between the Governor of Pennsylvania and Virginia occurring immediately after the arrest of Connolly and the Pennsylvania Justices, resulted in a meeting of Commissioners at Williamburg, Va., on May 19, 1774, to endeavor to establish the boundary line. This meeting was fruitless; but it is interesting to note that the Pennsylvania commissioners proposed as our western boundary a line to be drawn from the western end of Mason and Dixon's line, to be extended its proper distance of five degrees of longitude, thence northward but parallel at all points with the meanderings of the Delaware River. This line would have left almost all of the present county

of Washington, and corresponding portions of the counties north and south of it, in the "Pan-Handle" of Virginia. The proposition was rejected on the part of Virginia, her commissioners contending that under a proper construction of Penn's charter, the boundary line should run east of Pittsburgh.

Soon thereafter, in July, 1774, occurred what is called Dunmore's war, at the close of which Logan, the celebrated Indian Chief, made his supposed speech referring to the killing of his dusky family at the mouth of Yellow Creek below the present Steubenville: "Who is there to mourn for Logan?" Although this war was not of great magnitude, and was confined to what is now the state of Ohio, yet its approach so frightened the settlers of the Ohio and Monongahela valleys that it is said in a letter written by Valentine Crawford to Col. Geo. Washington, "There were more than one thousand people crossed the Monongahela in one day at three ferries that are not one mile apart.

Dunmore himself was with the white forces, chiefly adherents of the Virginia jurisdiction; and it is clear, as before intimated, that in the adjustment of the terms of peace, Dunmore, foreseeing the approaching revolution from the mother country, arranged such terms with the Indians as subsequently made them, or aided to make them, the allies of the British armies against our American patriots.

On his way down the river to the scene of the conflict, Lord Dunmore stopped at Fort Dunmore, as the fort at Pittsburgh had been baptized by Dr. Connolly, whence he issued his proclamation, this time personally and publicly asserting the claim of Virginia to all the territory west of the Laurel Hill mountains, and alleging instructions he had lately received from the English government to take it under his immediate control. A counter proclamation by Governor Penn followed on October 12, 1774, instructing the Pennsylvania magistrates to maintain the jurisdiction of Pennsylvania, nothwithstanding Dunmore's fulminations. Dunmore, on his return after the treaty of peace, which was made in the same month of October, stopped again at Pittsburgh, or at Fort Dunmore, as he called the place, when he was once more brought into personal contact with his adherents. He thence proceeded to Redstone, now Brownsville, where he had Thomas Scott arrested and brought before him for the offence of exercising the functions of a Pennsylvania magistrate. Thomas Scott was a distinguished man of that day and afterward. He became the first prothonotary of Washington county when organized, held many other

important public positions, and was a member of the first Congress of the United States under the Constitution of 1787. On the hearing before Lord Dunmore, he was bound over to appear for trial at a court for Augusta county, Va., to be held at Fort Dunmore on December 20, 1774.

DISTRICT OF WEST AUGUSTA.

The Augusta county court was not opened, however, on December 20, 1774, but on December 12th. A writ had been issued by Dunmore, in the name of his British Majesty, adjourning the county court of Augusta county from Staunton, Va., to Fort Dunmore, accompanied with a new commission of the peace, embracing with the old justices of the parent county the names of such of the adherents in the Monongahela valley as were regarded as proper persons for Virginia magistrates.

The District was called the District of West Augusta, and in its territory now in Pennsylvania it was bounded on the east by the Laurel Hill mountains and extended along the east side of the Allegheny River some distance beyond the Kiskeminitas, embracing all of Westmoreland, Allegheny, Beaver, Washington, Greene, and Fayette counties.

The first term of this Virginia court was held at Fort Dunmore on February 21, 1775, when George Croghan, John Campbell, John Connolly, Thomas Smallman, Dorsey Pentecost, John Gibson, George Vallandigham and William Goe appeared, took the qualifying oaths, and occupied their seats as justices. George Croghan, settled about where Lawrenceville now is, at first a Virginia adherent, had become quite a Pennsylvanian during Dunmore's war, but he was now made the presiding justice of Dunmore's court, and this brought him back once more among the Virginia partisans. From this date there were not only two different sets of magistrates, with their subordinate officers, assessors, and commissioners, over the same people in the Monongahela valley, but within a few miles of each other there were established two different courts, one at Pittsburgh, the other at Hanna's Town, regularly or irregularly administering justice under the laws of two different governments.

On the next day after the first sitting of the court, to wit, on February 22, 1775, Robert Hanna and James Caveat, two of the Westmoreland county justices, were arrested for the performance of their duties as Pennsylvania magistrates, and confined at Pittsburgh for


ORIGINAL MAP
OF THE
DISTRICT OF WEST AUGUSTA
AND COUNTIES OF
OHIO
YOHOGANIA
AND MONONGALIA
WESTMORELAND
WASHINGTON
FAYETTE
GREENE
BEAVER
ALLEGHENY
OHIO
Kiskiminitas River
Allegheny River
Monongahela River
Little Kanawha R.
Fork of Elk River
Middle Island Creek
Fishing Creek
Wheeling Cr.
Raccoon Cr.
Hannastown
Fort Pitt

import
the Un
before
for Aug
1774.

The
20, 17
more,
of Aug
with a
of the
nongal
magist
The
ritory
Hill m
River
morela
countie
The
Februa
Conno
Vallan
and oc
where
quite a
the pr
once n
not on
cers,
Monor
establi
Town,
two di
On
ruary
morela
duties

about three months, vainly endeavoring to obtain a release. The Governor and Council of Pennsylvania were probably engaged in the consideration of affairs of a most auspicious nature; but, in the latter part of June, 1775, the sheriff of Westmoreland county, aided by a posse of effective strength, proceeded to Pittsburgh and set the two justices at large, taking Dr. John Connolly with him to Hanna's town; and on the records of the Westmoreland county court, July Term, 1775, there is found an action of Capias in Case, indicating an arrest for damages, brought by "Robert Hanna, Esq. *v.* John Connolly."

THE REVOLUTION.

This case, however, was never brought to trial; for public affairs had taken on a new aspect. Our settlers for a time ceased to fight each other, but stood together expectant looking for a contest with the trained forces of the mother country. On April 19, 1775, Lexington and Concord became noted names of history. The astounding news from those villages had scarcely reached the Monongahela valley, when public meetings were held on the same day, to wit, May 16, 1775, both at Hanna's Town and Pittsburgh. At Hanna's Town the Pennsylvania adherents assembled; at Pittsburgh, the Virginia partisans. Each meeting passed a set of resolutions with equally forcible approval of the armed resistance to the invasion of American rights by the English government, and equally urging united action by force of arms successfully to sustain that resistance. We may call these sets of resolutions, adopted on the same day by the separate adherents of two colonial jurisdictions, the Monongahela Declaration of Independence. They antedate more than a year the Declaration of Independence adopted and read to the people at Philadelphia on July 4, 1776, and they antedate the celebrated Mecklenburg Resolutions of North Carolina by four days. All honor to the Monongahela valley!

A portion of the resolutions of the Westmoreland county meeting is worthy of being copied:

"Resolved, unanimously, That there is no reason to doubt but the same system of tyranny and oppression [referring to the oppressive measures of the British government] will (should it meet with success in Massachusetts Bay) be extended to other parts of America; it is therefore the indispensable duty of every American, of every man who has any public virtue or love for his country, or any bowells for pos-

terity, by every means which God has put in his power, to resist and oppose the execution of it; that for us we will be ready to oppose it with our lives and fortunes."

The spirit of the Revolution being abroad, the Monongahela and Ohio are soon rid of both John Connolly and his illustrious chief, Lord Dunmore. Dunmore became alarmed for his own safety and removed his family aboard the "Fowey," a British man-of-war in the Chesapeake. Connolly, soon after his release by the Westmoreland authorities was sent to General Gage commanding the British forces at Boston. General Gage returned him to Lord Dunmore, who granted him a commission as lieutenant-colonel of a regiment to be raised in the "back parts" and Canada, which meant, to be composed of Indians. While on his way to Detroit with his commission and instructions, he was captured by the American forces at Hagerstown, Md., when he was turned over to Congress and held a prisoner until 1780–81, and was then exchanged. After the Revolution he seems to have settled in Canada; subsequently he published in London his "Narrative" of his life and public acts, a copy of which was purchased of late years for a large sum of money and is now in the library of the Historical Society of Pennsylvania at Philadelphia. It has been reprinted in the pages of the *Pennsylvania Magazine of History*. But the Virginians and Pennsylvanians on the Monongahela and Ohio fought side by side under the Stars and Stripes; for it will not do to suppose that only the people of the east fought with the British lion. At least two full Pennsylvania regiments were raised west of the mountains and served in the battles of the east, a fact to be remembered by the local historian.

DIVISION OF WEST AUGUSTA.

The Revolution after July 4, 1776, was a fact accomplished, though its success was still in the dark future. Pennsylvania from a province, and Virginia from a crown colony, had both become independent states in the new American confederacy. And in October, 1776, the District of West Augusta, by an enactment of the General Assembly of Virginia, was divided into three new counties, Ohio, Yohogania, and Monongalia. For a short while before this division, the courts of West Augusta were transferred to Augusta Town, a mile west of Washington, Pa. At that place the courts were held September 17, 18, and November 19, 20, 1776. The new division then took effect. All three of the new counties came together at Catfish

Camp, now Washington. The courts of Ohio county were held at Black's Cabin, on Short Creek, now West Liberty, West Virginia; those for Monongalia county on the farm of Theophilus Phillips about two miles above New Geneva, in what is now Fayette county; while the courts of Yohogania were held on the farm of Andrew Heath, a mile or so above West Elizabeth in what is now Allegheny county. The courts of this county continued to be held regularly for the dispatch of business, civil and criminal and there was much of it, until August 28, 1780, when it was "Ordered that Court adjourn till Court in course." There was no court in course, for an agreement had been entered into for the running of the boundary between the two states on a line that would blot out Yohogania county forever.

ADJUSTMENT OF THE BOUNDARY LINE.

As has been stated, during the War of the Revolution the Pennsylvania and Virginia adherents on the Monongahela and Ohio ceased to fight each other, and not only sent more than two regiments of yeomenry to join with the continentals in the battles in the east, but they were obliged at the same time to provide for the protection of their families from the hostile incursions of the savage allies of the British in the west. Yet the boundary controversy was not yet determined.

On December 18, 1776, both houses of the General Assembly of Virginia passed a resolution that it was expedient and wise to remove as much as possible all causes of future controversy; and "to quiet the minds of the people that may be affected thereby, and to take from our common enemies an opportunity of fomenting mutual distrust and jealousy, the commonwealth ought to offer such reasonable terms of accommodation, (even if the loss of some territory is incurred thereby), as may be cordially accepted by our sister State, and an end put to all future dispute by a firm and permanent agreement and settlement." The resolutions then proceeded to authorize the Virginia delegates in Congress to propose to Pennsylvania that a line be drawn from the Maryland corner on Mason and Dixon's line due north to parallel of latitude 40°, and thence the southern boundary of Pennsylvania was to be run full five degrees of longitude west from the Delaware River, and from the end of that line the western boundary should be run corresponding with the meanderings of the Delaware River on the eastern boundary. This line would have given to Virginia a large part of what is now Fayette county, all of Greene county, and quite a portion

of Washington and of other counties to the north of it. Of course Pennsylvania could not accept this offer, though during 1777 and 1778 negotiations were made through the Virginia delegates; with such little interest, however, that the papers became lost.

It appears that early in 1779, just when is not now known, both States appointed commissioners to deal with the subject, and these commissioners — George Bryan, John Ewing and David Rittenhouse on the part of Pennsylvania, and Rev. James Madison, Rev. Robert Andrews and Thomas Lewis on the part of Virginia — met at Baltimore on August 27, 1779. The proceedings at this meeting were in writing, were reported to the Assemblies of the respective States, and may be found in Henning's Statutes of Virginia, Vol. X., p. 119. A final agreement was reached and put in writing on August 31, 1779. It was very simple in its terms, for a matter so long contested and of such magnitude. It was as follows:

"To extend Mason and Dixon's line due west five degrees of longitude, to be computed from the river Delaware, for the southern boundary of Pennsylvania; and that a meridian drawn from the western extremity thereof to the northern line of said State be the western line of said State forever."

This Baltimore agreement was ratified and finally confirmed by the Pennsylvania General Assembly on November 19, 1779. Virginia, however, held back, and whether from a dissatisfaction with the boundary as recommended by the commissioners or with an intention of benefiting her whilom adherents in the Monongahela valley, her Assembly had no action on the subject until the following summer. And what occurred in the meantime?

The General Assembly of Virginia, in May, 1779, passed an act "for the adjusting and settling titles of claimants to unpatented lands" upon the western waters, creating districts, with four commissioners to each, to hear proofs of settlement rights and grant certificates to claimants. The commissioners for Ohio, Monongalia and Yohogania counties were Francis Peyton, Philip Pendleton, Joseph Holmes and George Merriweather. All this before the Baltimore conference. But after the Baltimore agreement, and before its ratification by the General Assembly of Virginia, these commissioners met at Cox's Fort, in Washington county, near the Monongahela River, above Elizabeth, and at other points, and granted hundreds of certificates to claimants under Virginia settlement rights. These "Virginia Certificates," so-called,

afterwards formed the basis of a very large portion of the land titles of Washington county. Gen. Washington's title to over a thousand acres in Mount Pleasant township, Washington county, was based upon Virginia certificates. This act of sovereignty, before Virginia's ratification of the Baltimore agreement, raised a storm of indignation among the Pennsylvania adherents, and again some forcible but polite correspondence and negotiations resulted. The two States seemed about to resort to arms again to bring about an adjustment. The end of the contest, however, approached gradually, and on July 1, 1780, the Senate of Virginia passed an act of the Lower House which confirmed the Baltimore agreement "on condition that the private property and rights of all persons acquired under, founded on, or recognized by the laws of either country previous to the date hereof, be saved and confirmed to them," etc.; and Pennsylvania was then prepared, for the sake of an end to the controversy, to yield even to the humiliating conditions proposed, and on September 23, 1780, her General Assembly, protesting against the conditions, accepted and fully ratified "the said recited conditions, and the Boundary Line formed thereupon."

RUNNING OF THE BOUNDARY LINE.

It only remained to run and mark the line on the ground. Washington county was erected by an act of assembly passed on March 28, 1781, embracing all the land lying south of the Monongahela, to the southern boundary. But on June 3, 1781, only a temporary line was run. Troubles had ensued resulting in "Obstructions" producing "Anarchy and Confusion." Such terms as "Villanous Banditti" were of frequent use on either side, and letters in the State Archives are full of them. There was still much anxiety for the final establishment of the two boundaries.

In the spring of 1782 occurred the Indian raids into Washington county, followed by the slaughter of the peaceful Moravian Indians in the Ohio towns by Col. David Williamson's command, and the Crawford expedition against the Sandusky Indians, resulting in the burning of Col. Wm. Crawford at the stake. The times were almost as cloudy as ever. But in 1783, the authorities of each state appointed four commissioners to run and mark the permanent boundary. Rev. John Ewing, David Rittenhouse, John Lukens and Thomas Hutchins were appointed by Pennsylvania. By Virginia, Rev. James Madison, Rev. Robert Andrews, John Page and Thomas Lewis were appointed. June 1, 1784, was the time set for beginning the work. An interest-

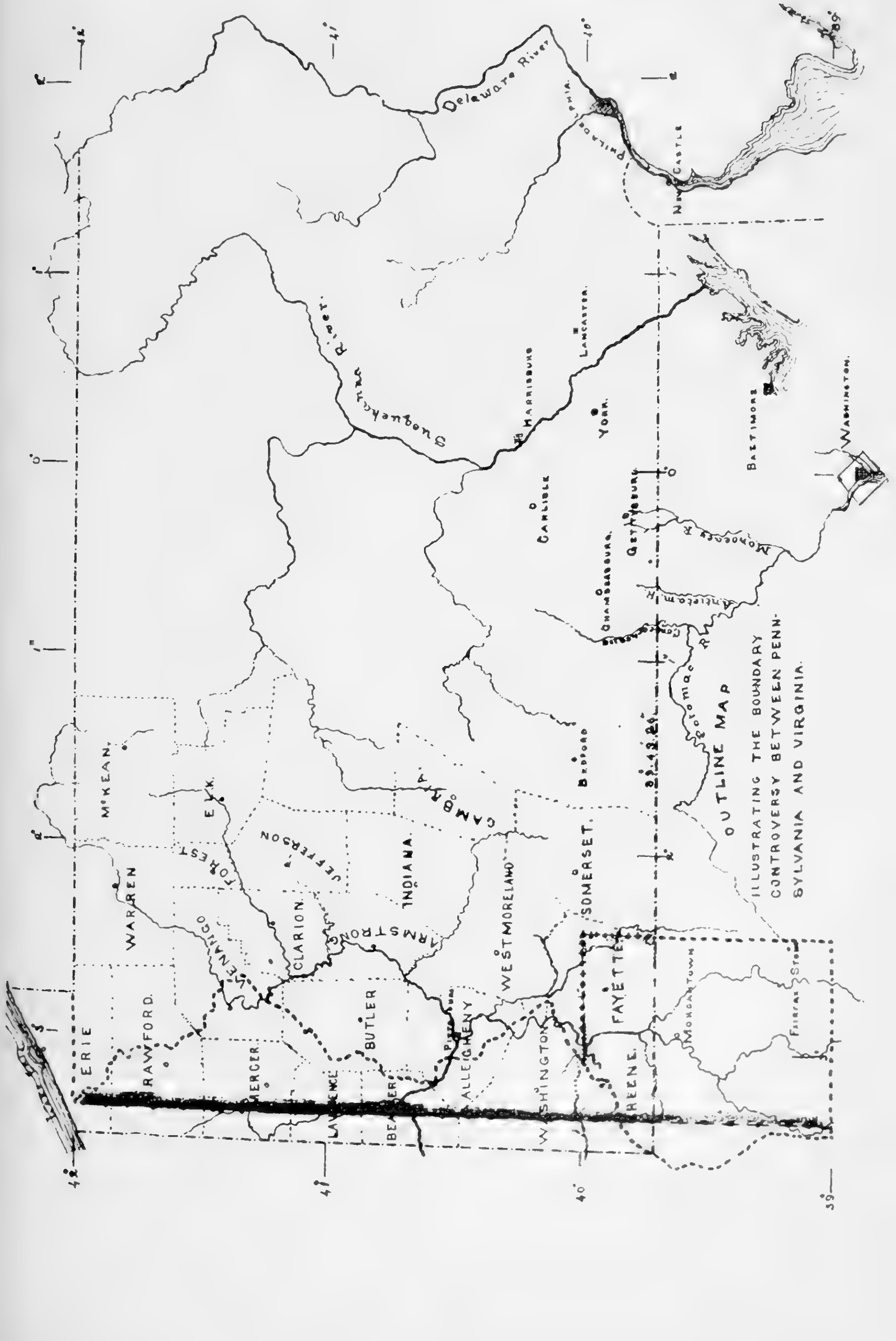
ing report of the running of Mason and Dixon's line to the western extremity thereof, dated December 23, 1784, will be found in the Pennsylvania Archives, Vol. X., p. 375. The meridian line itself from the southwest corner of the state, was finally run and marked, by David Rittenhouse and Andrew Porter, on the part of Pennsylvania, and Andrew Ellicott and Joseph Neville on the part of Virginia, on August 23, 1785.[9] For the Pennsylvania commissioners and their assistants, in order to insure the prompt and effective performance of their work, there was made the liberal provision of sixty gallons of spirits, twenty gallons brandy, and forty gallons of Madeira wine. And thus was the matter ended.

The original record or minute book of the old Virginia court, held for the District of West Augusta, first at Fort Dunmore, at Pittsburgh, afterwards on the late Gabby farm about a mile southwest of what is now the Borough of Washington, will now be presented, to be followed in a subsequent issue by the records of the court for Yohogania county (after the division of the District of West Augusta into the three new Virginia counties), held on the farm then owned by Andrew Heath near what is now West Elizabeth, in Allegheny county.

These minute books belong to the Washington County Historical Society at Washington, Pa. Those of the old court of Monongalia county, held at the house of Theophilus Phillips on George's Creek, Fayette county, were destroyed on the burning of the court-house at Morgantown in 1796; while those of the old court of Ohio county should be found at Wheeling, W. Va.

Copies of the records as printed in these ANNALS will go into the hands of persons familiar with the local history of southwestern Pennsylvania, who are requested to aid in identifying and locating the individuals and places referred to in them, for future publication.

[9] Colonial Records, Vol. XIV., p. 655; Vol. XV., p. 38.



OUTLINE MAP ILLUSTRATING THE BOUNDARY CONTROVERSY BETWEEN PENNSYLVANIA AND VIRGINIA.

XXI. MINUTE BOOK OF THE VIRGINIA COURT HELD AT FORT DUNMORE (PITTSBURGH) FOR THE DISTRICT OF WEST AUGUSTA, 1775–1776.

EDITED BY BOYD CRUMRINE, OF WASHINGTON, PA.

[NOTE: In copying these minutes no portions will be omitted, save certain lists, here and there, containing the names of cases called and unintelligible memoranda concerning them, with nothing to identify the parties, the causes of action, or the localities whence they came.]

[THE FORMAL ORGANIZATION OF THE COURT.]

(1)[10] HIS MAJESTIES Writ for adjorning the County Court of Augusta from the Town of Staunton to Fort Dunmore, and with a new Commission of the Peace and Dedimus and a Commission of Oyer and Terminer and Dedimus from under the hand of John, Earl of Dunmore, his Majesties Lieutenant and Governor in chief, bearing date the Sixth day of December One Thousand Seven Hundred and Seventy four, directed to

Silas Hart, James Lockhart, John Dickinson, John Christian, Daniel Smith, Archibald Alexander, John Poage, Felix Gilbert, Abraham Smith, Samuel McDowell, George Moffett, Sampson Mathews, Alexander McClenachan, William Bowyer, Matthew Harrison, George Mathews, Michael Bowyer, Alexander Robertson, John Gratton, John Hays, Thos. Hugart, James Craig, Elijah McClenachan, John Frogg, Jonah Davidson, William Tees, John Skidmore, George Croghan, John Campbell, John Connolly, Edward Ward, Thomas Smallman, Dawsey Penticost, John Gibson, William Crawford, John Stephenson, John McCullough, John Cannon, George Vallindigam, Silas Hedge, David Shepherd, and William Goe, Gentlemen,

being read, & thereupon, pursuant to the said Dedimus, the said George Croghan, John Campbell, John Connolly, John Gibson, George Vallandegham, William Goe, Gentlemen, took

[10] The figures to left of pages in brackets refer to the pages of the original MS. Editor Annals Carnegie Museum.

the Usual Oaths to his Majesties Person & Government, Subscribed the Abjuration Oath and test, and also took the Oaths of Justices of the Peace, and of Justices of the County Court in Chancery, and of Justices of Oyer & Terminer, all which Oaths were administered to them by Thomas Smallman and Dawsey Penticost, and then John Campbell and John Connolly administered all the aforesaid Oaths to the aforesaid Thomas Smallman and Dawsey Penticost, who took the same and subscribed the Abjuration Oath and Test, on which the Court being Constituted the following Members were Present, February 21st, 1775:

George Croghan, John Campbell, John Connolly, Thomas Smallman, Dawsey Penticost, John Gibson, George Vallandegham and William Goe, Gentlemen Justices—

(2) George Brent and George Rootes took the Usual Oaths to his Majesties Person and Government, Sub the Abjuration Oath and Test, and then took the Oaths of Attorneys.

Ord that John Campbell, George Redman, Thomas Redman, and Benja. Renoe, or any 3 of them, being first sworn, Veiw a Road from Fort Dunmore to Frederick Dunfields, and make a report of the Conveniences and Inconveniences to the next Court.

Joseph Hill is appointed a Constable in the room of Jacob Vanmetere, and that he be summoned to be sworn in the office.

On the Petition of James Johnston and others, It is Ord Edward Cook, Joseph Hill, Senr., Levy Stevens, Gilbert Simpson, Rich'd McMahon, John Decker, Paul Froman, and James Innes, they being first sworn, Veiw a Road from the Road from Thomas Gists to Fort Dunmore to Paul Fromans on Shirtees Creek, by James Devores Ferry, and make a report of the Conveniences and Inconveniences to the next Court.

William Elliott, being bound over to this Court by Thomas Smallman, Gent., for disturbing the minds of his Majesties Good people of this County, by demanding in an arbitrary and Illegal Manner of sundry Persons what Personal Estate they are possessed of, that the same may be tax'd according to the Laws of Pennsylvania, being called, appeared and on hearing the argument of the attorneys the Court are of opinion that he be Committed to the Goal of this County, and there remain until he Enter into recog. in the sum of £100, with 2 Srtys in the

Sum of 50 £ Each, for his good Behavior for the space of One Month; and thereupon the sd Wm. Elliott, with John Harvie and Chas Irons, ack'd themselves Indebted to our Sovereign Lord the King, the sd Elliott in the Sum of £100 and the sd. Harvie and Irons in the Sum of £50 Each, to be levied on their respective Goods and Chattels, Lands and Tenements, in Case the sd. Wm. Elliott is not of good Behaviour for the Space of one month.

(3) Ordered that the Court be Adjourned until to Morrow Morning 10 o'clock. GEO: CROGHAN.

At a Court con'd and held for Augusta County at Fort Dunmore February 22d, 1775,

Prest John Connolly, Thomas Smallman, Dorsey Pentecost, Wm Goe, Gentlemen, Justices.

John Canon, one of the Gent in the Commission of the peace, took the Usual Oaths to his Majesties person and Govemt, Subscribed the Abjuration Oath and Test, and then took the Oath of a Justice of the peace, and of Justice of the County Court in Chancery, and of Justice of Oyer and Terminer

On the Complt of John McAnully ag'st his Master, Casper Reel, for beating and abuseing him, It is ordered that he be summoned to appear here the next Court, to answer the Complt, and with the Servt.

Prest, John Canon.

On the petition of Alexr. Duglas and others, It is Ord that Wm. Crawford, Providence Mounce, Ezekiel Hickman, Joseph Beeler, John Vanmetere, Morgan Morgan, Vincen Colvin, Henry Taylor, Van Swearengen, they being first sworn, Veiw a road from Providence Mounce's Mill, by Ausberger's Ferry, and from thence to Catfish Camp, and make a report of the Conveniences and Inconveniences to the next Court.

Ordered that Robert Henderson, Benja. Kuykendall, John Robinson, and James Sulivan, they being first sworn, Veiw a Road from Fort Dunmore to Beckets fort, and make a report of the Conven and Inconveniences to the next Court.

Prest., John Gibson.

(4) David Semple, Gent, is recommended to the Gentn appointed to exam Attos., that he is a Person of Probaty, Honesty, and Good Demeanor.

On the Motion of Henry Heath, It is ordered that Silas Dexter, Gabriel Cox, Rich'd McMahon, Benja. Sweet, Robt. Henderson, Veiw the most Conven Way from fort Dunmore to Henry Heaths, they being first sworn, and make a report of the Inconv and Conven to the next Court.

Admon of the Estate of Wm. Craig, dec'd, granted to Andrew Vaughan, a Creditor, he having comp'd with the Laws.

Ord. that Gabriel Cox, Rich'd McMahon, James Bruce, and Henry Heath, or any 3, app the Est.

Patrick McElroy took the Usual Oaths to his Majesties Person and Govern, Sub the Abjur Oath and Test, and then was sworn a Deputy Sheriff.

William Christy took the Usual Oaths to his Majesties Person and Govern, Sub the Abj Oaths and Test, which is Ordered to be Certified on his Commission of a Lieutenant of Pittsburg and its Dependencies of the Militia.

Simon Girty took the Usual Oaths to his Majesties Person and Govern, Sub the Abjuration Oath and test, which is Ord to be Certified on his Com of a Lieutent of the Militia of Pittsburg and its Dependencies.

Jacob Bousman took the Usual Oaths to his Majes Person and Govern, Sub the Abjur Oath and test, which is Ord to be Certified on his Comn of Ensign of the Militia of Pittsburg and its Dependencies.

Ord that Paul Froman, Thomas Cook, Josiah Crawford, Jacob Long, and Rich'd Crooks, they being first sworn, Veiw
(5) a road from Fort Dunmore to Paul Froman's and make a report of the Conveniences and Inconveniences thereof to the next Court.

Prest., John Campbell.

William vs. Bresser; deft moved for a ded. to take the deps. of Jacob Dorenin, a Wits who is agoing down the Ohio river, which was overuled.

Ab., John Connolly.

John Connolly took the Usual Oaths to his Majesties person and Govern, Sub the Ab Oath and test, which is Ord to be Certified on his commission of Major of the Millitia.

Prest., John Connolly.

Windle Ourey, being bound over to this Court for acting as an assessor under the Laws of Pennsylvania, appeared, and hav-

ing made Confession to the Court, it is Ordered that he be discharged from his recog.

James Cumerford being bound over to this Court on Complt of John Gibson, Gent, being called and failing to appear the Prosecution is withdrawn.

Ord. that the Sheriff make use of the Room in the Fort now Used as a Guard Room as a Goal for this Part of the County, and also that John Campbell and Dorsey Penticost, Gent, with the Surv. lay of Prison Bounds for the same, Includ the ally of the fort and two rods wide to the town

Robert Hannah, being bound over to this Court for openly disturbed the peace by interrupting the execution of Legal Process by the officers of this Government, and did actually imprison a Certain Philip Baily in the discharge of his duty as a Consta, ag'st the Peace of our Sovereign Lord the King, being called, appeared and offered a Plea to the Jurisdiction of the Court, which Plea was Overuled; and It is ordered that he be Committed to the Goal of this County, and there to remain
(6) until he Enter into recog in the Sum of £1000 with 2 Secys. in the sum of £500 Each, to be levied of their respective Goods and Chattels, Lands and Tenemets, in case Robt. Hanah is not of Good Behaviour for a Year and a day, and also desit from acting as a Majestrate within the Colony of Virginia by any authority from the Province of Pennsylvania, and that he keep the peace to all his Majesties Leige Subjects in the Mean time.

James Caveat, Gent, being bound over to this Court for sundry times Malevolently opposed the authority of His Majesties officers of the Government of Virginia, and has riotsly opposed the legal Establishment of his Majesties Laws in this County, Contrary to the peace of our Sovereign Lord the King, being called, appeared and offered a plea to the Jurisdiction of the Court, which was overuled; and it is ordered that he be Committed to the Goal of this County and thereto remain until he Enter into recog in the Sum of £1000 with two Secys in the Sum of £500 Each, to be levied of their respective Goods
(7) and Chattels, Lands and Tenements, in case James Caveat is not of Good Behaviour for a Year and a day, and also desist from acting as a Majestrate within the Colony of Virginia by

any authority derived from the Province of Pennsylvania, and that he keep the peace to all his Majesties Leige Subjects in the mean time.

Francis Brown took the Usual Oaths to his Majesties Person and Govern, Sub the Abjur Oath and test, and was Sworn as a deputy Sheriff, with the Consent of John Christian by a note from under his hand

James Smith being bound over to this Court for acting as a Commissioner under an authority derived from under the Province of Pennsylvania within the Colony of Virginia, being called appeared, and on being heard It is Ord that he Committed to the Goal of this County, and there to remain until he Enter into recog in the Sum of £100 with two Secys. in the Sum of £50 Each, to be levied of their respec Goods and Chattels, Lands and Tenements, in case he is not of Good Behaviour for a Year and a day, and also desist from acting as a Commissioner from under any authority derived from under the province of Pennsylvania within this Colony

Ord that Davd Steel, John Wals, Oliver Miller, and Nathan Couch, they being first sworn, Veiw a Road from Devor's ferry to the road that leads from fort Dunmore to Dunfeilds, to join Dunfeild's road on Shirtee's Creek near Ben Renoes, and make a report of the Conven and Inconven to the next Court

(8) Ord that the Sheriff Imploy a Workman to build a Ducking Stool at the Confluence of the OHio with the Monongohale and that the person Imployed bring in his Charge at the Laying of the Levy.

Bousman vs. McGoldrick, Joseph Chriswell Spbd.

Edward Armstrong, being bound over to this Court on the Complt of Frederick Ferrie, for Stealing a Hog the prop of the sd. Ferrie, on hearing the Wits and the parties by their Attos, and It is ordered that the Complt be dismised.

David Steel took the Usual Oaths to his Majesties Person and Govern, Sub the Ab Oath and test, which is Ord to be Cert on his Commission of Ensign of Pittsburgh and its Dependances.

Ord that Thos. Brown, Bazil Brown, Wm. Colvin, Reuben Camp, and Conrad Walter, they being first sworn, Veiw a Road from Old Redstone fort to Conrad Walkers, and make a report of the Conven and Inconv to the next Court

Ord that the Court be adjourned until to Morrow Morning 10 o'Clock. JNO. CONNOLLY.

At a Court Con'd and held for Augusta County February 23d, 1775 Prest, Jno. Campbell, Jno. Gibson, Thos Smallman Wm. Goe, Jno. Cannon.

James Berwick, Gent, is recommed to the Gentlemen to Examine Attos, as a person of Probaty, Honesty, and good Demeanor.

Andrew Ross, Gent, is recommended to the Gentlemen to Examine Attos, as a person of Probaty, Honesty, and Good Demeanor.

(9) On the Motion of Henry Heath, leave is granted him to keep a ferry on the Monongohala River at his own Plantation, and he provide a Boat for the sd ferry

On the Motion of Wm Lynn, leave is granted him to keep a ferry on Monongahale River, from his House over the River to the Land of Fras. Holls (?),[11] and that he provide Boats.

On the Motion of Mich'l Cresap, leave is granted him to keep a ferry on Monongohale River at Redstone fort to the Land of Indian Peter, and that he provide a Boat.

On the Motion of James Devore, leave is granted him to keep a ferry on Monongohale River, from his house over the river to the Mouth of Pidgeon Creek, and that he provide Boats.

Luke Joliff, being committed and brought before the Court for deserting from the Militia, and for takeing with a stand of arms, and for preventing the Indians for not delivering up Sund Prisoners, then in their custody; On hearing Sund Wits and the s'd Luke, the Court are of Opinion that he for the s'd offence receive for the s'd offence of deserting 500 Lashes with a Cat-o'nine tails on his bare back, well laid on, and it is said to the Sheriff that execution thereof be done at such times and in such number as not to endanger life or member.

[Here follows a long list of cases, seventy-four in number, indicating that the cases had been called and some order made in them. Only the surnames of the parties being given, with unintelligible memoranda which do not indicate the nature of the action, nor identify or localize the parties, this list is omitted.]

Ord that Edward Cook, Joseph Hill, Senr., Levy Stevens,

[11] Name illegible.—EDITOR.

Gilbert Simpson, Rich'd McMahon, John Decker, Paul Frooman, and James Innes, they being first sworn, Veiw a Road from Thos. Gists to Paul Froomans Mill on Shirtees Creek, and make a report of the Conven and Inconvenc to the next Court.

(12) Ord that Thomas Crooks, Wm. Bashears, Robt. Thornton, Thos. Egenton, and Philip Whittan, they being first sworn, Veiw a road from Redstone old fort to Shirtees Creek to Paul Froomans, and make a report of the Conv and Inconv to the Next Court.

[On the motion of Jacob Bousman, leave is granted him to keep a ferry across the Monongohale River, from his House to the Town oposite thereto, & that he provide & keep a suff numer of Boats for that Purpose.[12]]

John Campbell, Gent, with his Servt Michl Haney, came into Court, and the sd. John acknowledged that he had served the time mentioned in his Ind, which is Ord to be Certified.

Ord that Dav'd Steel, Thos. Bond, John Mckee, and Silas Dexter, they being first sworn, Veiw a road from the Mouth of the Yough River, at Mckee's ferry, to the Road from Devore's ferry to Renoe's near Sampson Beavers, and so On to Fromans Mill, and make a report of the Conv and Inconvenien to the next Court.

On the Motion of Dorsey Penticost, It is Ord that his Mark be recorded a Cross in the left Ear and his Brand D P.

Christopher Turby, John Carpenter, Joshua Wright, Joseph Hill, Snr, John Hawthorn, Emson Brumfield, Jno. Harden, Junr., John Pettyjohn, John Warick, James Booth, Reeson Virgin, Ezekial Rose, Wm. Hawkens, James Taylor, Nathl Blackmore, James Murdough, Jas. Young, Abraham Slover, Jno. Bell, John Dousman, Andrew Robinson, Nicholas Higarthy, Barney Wistner (?),[13] Jno. Castleman, Elias Myers, Wm. Teagard, Junr., Joseph Erwin, Jno. Nicholas, James Baird, Sam'l Hinly, Moses Smith, Terry Moore, Michl Martin, Rich'd Wells, and Garshom Hull, are app'd Constables, and It is Ord that they be summoned to be sworn before a Majestrate, or Attend at the next Court to be Sworn.

(13) John Campbell and Dorsey Penticost, the persons appointed

[12] This entry, placed in ( ), is erased in the original record.

[13] Name somewhat illegible.—EDITOR.

to lay off the Prison bounds, made a report, and Ord to be Recorded.

Ord that the Sheriff Summon a Grand jury for the Inquest of the body of this County, to appear here in May next.

On the Motion of Sam'l Semple, It is Ord that his Mark be recorded a Crop of the right Ear and a Nick in the Edge.

On the Motion of John Gibson, It is Ord that his Mark a Slit in the right and a Crop in the left Ear and brand I G.

Ordered that Alexander Mckee, James Innis, Thomas Galbreath, Wm. Harrison, Thomas Gaddis, Jno. Swearingen, Thomas Freeman, Benjamin Davis, Edward Cook, John Whitacre, Philip Ross, David Rogers, James Chew, David Scott, Chas. Wheeler, Thos. Crooks, Jno. Robertson, John Nevill, Michl Rough, Isaac Mason, Eli Coulter, Wm. Elliott, Henry Vanmetre, Geo Rodgers Clark, Rich'd Yates, John Irwine, Christopher House (?), and Joseph Beeler, are humbly recommended to his Excellency, the Governor, as proper persons sons to be added to the Commission of the Peace for this County.

Edward Armstrong and James Ryan was brought before the Court for fighting in the Court Yard and disturbing the Court; It is Ord that they be committed to the Goal of this County, and there to remain until they Each Enter into recog in the Sum of £10 with 2 Secys in the Sum of £5 Each, to be levied, and for their appearance at the Grandjury in May next, and that his Majesties deputy Atto prosecute them for the same: Sum Geo Ashton, John Collins, and Sam'l Mckinsie (?).[14]

(14) On the Motion of John Canon, It is Ord that his Mark be recorded, a Crop in the right Ear and half Crop in the left.

A Bill of Sale from James Cumberford to Geo Aston was prov'd by Valentine Thos. D'Alton, the Wit, and O R.

A Bill of Sale from Simon Butler to Geo Aston was prov'd by Valentine Thos. D'Alton, one of the Wits, and O R.

An Agreement between Cornelius Dougherty and Geo Aston was prov'd by Valentine Thos. D'Alton, one of the Wits, and O R.

Geo Aston took the Usual Oaths to his Majesties person and Government, Sub the Ab Oath and test, and Ord to be Cert'd on his Commission of Captain of the Militia.

[14] Spelling doubtful; word illegible.—Editor.

Licence to keep an ordinary is Granted to John Ormsby, he hav'g compld with the Law.

Licence to keep an Ordinary is Granted to Sam'l Ewalt, he hav'g Compld with the Law.

The Last Will and Test of Shedrich Muchmoor, dec'd, was proved by Valentine Thos. D'Alton and Wm. Plumer, two of the Wits, and O R, and On the Motion Mary Muchmoor the Widow, Admon with the Will Annexed is granted her, she hav'g Comp with the Law.

Ord that Benja Tomlinson, Joshua Baker, Jacob Cockran, and Jos Cockran, and any 3, app the Est of Shedrich Muchmoor, dec'd, and return the App to the next Court.

Jonathan Muchmoor of the age of 19 years Orph of Shedrich Muchmoor, dec'd, chose Thos. Smallman his Gaurd, who Compld with the Laws

(15) Ordered that the Court be adjorned until to Morrow Morning 10 o'Clock. JNO. CONNOLLY.

At a Court Con'd and held for Augusta County at Fort Dunmore Feby. 24th 1775,

Prest. John Campbell, Jno. Connolly, Thos. Smallman, John Gibson, Dorsey Penticost.

Ord that Providence Mounce, Wm. Crawford, Paul Froman, James Innis, or any three, being first sworn, Veiw the Most Conv way for a road from Mounce's Mill to Froomans Mill, and make a report of the Conv and Inconv to the next Court.

P. Jno. Cannon.

Licence to keep an Ordinary is granted to Frederick Feree, he hav'g Comp with the Law.

The same to Jacob Bousman, on the South side of the Monongohale River oppisite the Town.

On the Motion of Samuel Sinclair, who lives on the forks of the river Monongohale and Youghagano leave is granted him to keep a ferry over Each of the Rivers, and that he keep boats.

Licence to keep an Ordinary is granted to Sam'l Sample, he hav'g Comp with the Laws.

Wm Hawkins, Andrew Robertson, and Nicholas Hagerty, took the Usual Oaths to his Majesty's Person and Governm, Sub the Ab Oath and Test, and then took the Oaths of Constables.

Bertney Whitney took the Usual Oaths to his Majesties person and Govern, Sub the Ab Oath and Test, and then took the Oath of a Constable.

(16) Ord that Peter Elrod John Whitacer, Andrew McMeans, and Benja Davis, or any 3, they being first sworn, Veiw a Road from Fromans Road to Sam'l Sinclairs, the nearest and best way, and make a report of the Conv and Incon to the next Court.

Ord that Silas Dexter, Gabriel Cox, Rich'd McMahon, Benja Sweet, and Robt Henderson, or any 3, they being first sworn, veiw the nearest and best way from Sam'l Sinclairs to Fort Dunmore, and make a report of the Conven and Inconv to the next Court.

Ord that Chas Bruce, Geo Aston, Abraham Slover, and Josiah Osburn, or any 3 of them, being first sworn, Veiw the nearest and best way from Fort Dunmore to Chas. Bruces on Racoon Creek, and make a report of the conv and Inconv to the next Court.

His Majesties Writ for adjorning this Court from Fort Dunmore to the Town of Staunton being read, It is Ordered that the s'd Court be Adjorned Accordingly.

JNO. CONNOLLY.

His Majesties Writ for Adjorning the County Court of Augusta from Staunton to Fort Dunmore being read, this 16th May 1775,

Present Geo Croghan, Jno. Campbell, John Connolly, Thos. Smallman, John Gibson, John Cannon.

Edward Ward and John McColloch took the Usual Oaths to his Majesties Person and Govern, Sub the Ab Oath and Test, and then took the Oath of Justice of the peace, and of
(17) Justice of the County Court in Chancery, and of a Justice of Oyer and Terminer.

Henry Peyton took the Oath of an Atto and is admitted to Practice as such in this Court.

Small vs Gray, Nordica Mordica Spbd.

Shilling vs Young, Geo Corn Spbd.

Cresap vs Swearingam, Michl Tygert Spbd.

At a Cald Court held for the Examination of Thos Glenn, who stands Committed to the Goal of this County, charged with the Murder of his Servt Man Peter Eglington,

Prest. Geo Croghan, Jno Campbell, John Connolly, Edward Ward, Thos. Smallman, Jno. Gibson, Geo Vallandigham.

The above named Thos. Glenn was brought to the barr and upon Examination denied the fact wherewith he stands charged; whereupon several Witnesses were Sworn and Examined, and upon Consider at which the Court are of opinion that he is Guilty of the fact wherewith he stands Charged, and that he ought to be tried for the s'd Supposed fact at the General Court in October next, at the 6th day thereof, and in Order thereto he is remanded to the Goal of this County and thence to be removed to the Pub Goal in the City of Wmsburg.

Be it Remembered John McCollock, Moses Williamson, James Johnson, James Nowland, of this County, ackn'd themselves Indebted to our Sovereign Lord the King in the Sum of £100 Each, to be levied of their respective Goods and Chat-
(18) tels, Lands and Tenements, in Case they do not appear at the Capitol, in the City of Wmsburg, on the 6th day of the next General Court, and then and there give evidence ag'st Thos. Glenn for the Murder of his Servt Peter Eglington, and not depart without leave of the Court.

Then the Court did rise.

Spa. to Jos. Blackford,
for the Prisoner. Geo: Croghan,

Noble vs Chamberlain. Walter Briscoe Spbd.

Prest: Geo Croghan, John Connolly, Edward Ward, John Cannon, John McCulloch, John Gibson;

Michael Ginder and Geo Ginder Ack'd L & R to Nicholas Mace and O R.

The same to Francis Mcbride and O R.

The Commission for the private Examin of Cath, the Wife of Michl. Ginder, and Susanna, the wife of Geo Ginder, to a tract of land sold by their Husbands to Nicholas Mace, being ret. is O R.

The same to Fras. Mcbride and O R.

Susanna, the wife of Geo Ginder, came into Court, and relinq her right of Dower to 100 acres on the branches of Brooks Creek, formerly conveyed by her husband to Fra's Mcbride, and O Cd.

Benja Renoe, Geo Redman, and Thos. Redman, 3 of them,

persons appointed to Veiw a road from Fort Dunmore to Frederick Dunfields and make a report, and made their report; It is Ord that the Road be Established, and that Geo Redman, and Benja. Renoe be Surveyors thereof, and that the Tithables within 3 Miles on Each side work thereon.

(19) Wm. Crawford, one of the Gent in the Com of the Peace, took the Usual Oaths to his Majesties Person and Govern, Sub the Ab Oath and test, and then took the Oath of a Justice of the Peace, and of a Justice of the County Court in Chancery, and of a justice of Oyer and Terminer.

Pres, Wm. Crawford.

On the Petition of Maly Hayes, and others, It is Ord that Peter Elrod, John Whitacre, Andrew McMeans, Benja Davis, Silas Dexter, Gab'l Cox, Rich'd McMahon, Benja Sweet, and Robt. Henderson, or any 6 of them, being first sworn, Veiw a Road from Dorsey Penticost's, by Peter Barrackman's ferry, to fort Dunmore, and make a report of the Conven and Inconven to the next Court.

On the Motion Capt. Paul Froman, It is Ordered that John Decker, John Muns, James Innes, and Thomas Edgington, or any 3 of them, being first sworn, Veiw the most Conven Way from Froman's Mill on Shirtees Creek, to Fromans Mill on the East side of the Monongohale, and make a report of the Conven and Inconven to the next Court.

A Grandjury for the Inquest of the body of this County, to wit: Geo McColloch, foreman, Oliver Miller, Abraham Teagarden, John Swann, Jesse Pigman, Bazil Brown, Rich'd Waller, Jacob Vanmetre, Wm. Colvin, Josiah Wallace, Moses Williamson, John Deckar, Rich'd McMahon, Rich'd McGlaughlin, and Daniel Cannon, having received their charge retired.

(20) George Croghan Ackn'd a Barg and Sale and a receipt to Benjamin Tate and O R.

The same to Jacob Bousman and O R.

Teagarden vs Hammon James Crawford Spbd.

Cresap vs Peterson Indian Erasimes Backys Spbd.

vs Cox John Wall Spbd.

Woods vs Gray Wm. Cuningham Spbd.

Samples vs Fernsley Walter Grymes Spbd.

Cresap vs Vaughan John Gab'l Jones Spbd

Elliott vs Martin- Jacob Bousman Spbd.
Boly vs Springer John Springer Spbd
Hawkins vs Wheat James McConnel Spbd.
Cook vs McConnel Conrad Wheat Spbd.
Ab Geo Croghan
Williamson vs Mills Wm. Hawkins Spbd
Swagler vs Mills Wm. Hawkins Spbd
Bell vs Finn. James Crawford Spbd.
Vallandigham vs Crinnell.
Colvin vs Frederick Geo Wilson Spbd.
Boly vs Ross.
Wilcox vs Craighead James Sulivan Spbd.
Cook vs Froman. James Chambers Spbd
Boley vs Springer in Debt Paul Froman Spbd.
Penticost vs Briscoe Pat McElroy Spbd
Kuykendal vs Allenthrop Paul Froman Spbd.
Bond vs Mordica

On the Complt of James O'Neel against his Master, Patrick Fleming, for beating and abuseing him, It is Ord that his Master be Sum'd to appear here the next Court, to Ans the Complt, and that he in the mean time treat well and give Security for
(21) the same, himself in the sum of £30, and 1 Secy in the Sum of £15; and thereupon he with James Chambers his Secy Ack'd himself Indeb to our Sovereign Lord the King in the Sum of 30£, and Jas. Chambers, his Secy, also in the Sum of £15, to be levied of their respective Goods and Chattels, Lands and Tenements, in Case he doth not use his servt, James O'Neel, well til the next Court

On the Complt of John Connolly, Gent, ag'st Geo Wilson, Gent, as a disturber of the peace, on hearing the parties the Court are of Opinion that the Complt be dismissed,

Ord that Rich'd Heth (?),[15] Dav'd Steel, Thos Cook, Rich'd Crooks, and Paul Froman, or any 3 of them, being first [Sworn], Veiw a road from Fort Dunmore to Paul Fromans Mill on Shirtees Creek, and make a report of the Conv and Inconv to the next Court.

Ord that the Court be adjorned until to Morrow Morning 10 o'clock. JOHN CAMPBELL.

[15] Spelling doubtful; illegible.—EDITOR.

At a Court Com'd and held for Augusta County May 17th, 1775,

Prest. Geo Croghan, Edward Ward, Thos. Smallman, John Gibson, John McCullough, Wm. Crawford.

Ord that John Vance, Providence Mounce, Edward Dial, and Wm. Mckee, or any 3 of them, being first sworn, Veiw the most Conven Way from Maj Crawford's to near the forks of Indian Creek, and make a report of the Conv and Inconv to the next Court.

(22) On the petition of Rezin Virgin and others, it is Ord that Philip Shute, Rich'd Waller, Abraham Teagarden, Wm. Teagarden, Geo Teabolt, and Rezin Virgin, or any 3 of them, being first sworn, Veiw a road from the foot of Laurel Hill, by Wm Teagarden's ferry, to the Mouth of Wheeling, and make a report of the Conven and Inconv to the next Court.

On the Motion of Dav'd Mckee, for leave to keep a ferry over the Monongohale and Youghogana, which Motion being opposed, on hearing the parties It is Consid that the ferry is Unnecessary; It is therefore Ord that the s'd Motion be rejected.

The persons app'd to Veiw a road from old Redstone fort to Conrad Walters, and made a report, It is Ord that the road be Established, and that Jacob Beason be Overseer from Conrad Walters to Jennings's run, and Robt. Jacman be Overseer from the East side of Jennings run to James Chamberlains Run, on the East side of the dividing Ridge, and that Philip Fouts be Overs from Chamberlains run to the River at old Redstone fort, and that the tithe's within 3 miles on Each side work thereon

Prest. John Cannon

John White, being bound over to this Court on the Comp of Thomas Christy, for stealing his swine, on hearing the witnesses the Court are of Opinion that he is guilty of the fact wherewith he stands Charged, and that he be Committed to the Goal of this County, there to remain until he Enter into recog in the Sum of £100 with two Securitys, in the Sum of £50 Each, for his good behavior, and for his personal appearance at the next Grand jury Court to be held here, and that his Majestys deputy Atto prefer a bill of Indict ag'st him.

Thomas Martin being bound over to this Court on the Complt of Archibald Hamilton for Burning his House in the Neighbourhood of Sandy Creek, whereby he has lost some of his Effects, being called, appeared, and on hearing the parties by their Atto and Sund Wits the Court are of Opinion that he is guilty of a High Misdemeanor; It is Ord that he be Committed to the Goal of this County for the s'd offence, and there to remain until he Enter into recog in the Sum of £100 with 2 Secys in the Sum of £50 Each, for his good behaviour for a Year and
(23) a day; and thereupon he with Jacob Bousman and Hugh O'Harro, his Secy, ack'd himself indeb to our Sovereign Lord the King in the Sum of £100, and the s'd Jacob Bousman and Hugh O'Harro Ack'd themselves Each Indeb to our Sovereign Lord the King in the sum of £50 Each, to be levied of their respec Goods and Chattels, Lands and Tenements, in case the s'd Thos. Martin is not of Good behaviour for a Year and day.

Peter McCartney Ack'd a Claim to 50 Acres of Land to John Campbell, Gent, and O R.

Cook vs Shilling, Peter Hillibrand Spbd.

On the Complt of Benjamin Kyser against Hugh Davidson for a forceable Entry made, being called, appeared, and on hearing the parties and the Wits the Court are of Opinion that he is Guilty, and that he be Committed to the Goal of this County, and there to remain until he Enter into recog in the Sum of £100, with 2 Secys in the Sum of £50 Each, and thereupon he with John Caveat and John Sampson his Secys Ack'd himself Indeb to our Sovereign Lord the King in the Sum of £100 and the s'd John Caveat and John Sampson Ack'd themselves Each to owe to our Sovereign Lord the King in the Sum of £50 Each to be levied of their respective Goods & Chattels, Lands & Tenements, in Case thes'd Hugh Davidson is not of Good Behaviour for a Year and a day.

Fred Ferree, being bound over to this Court on the Complt of Geo Phelps, for beating him, being called, appeared, and on hearing the parties & the Witnesses, the Court are of Opinion that the Complt be dismised.

(24) Stevens vs Shilling Peter Hillibrand Spbd

Mitchell vs Scott Michl Tygert Spbd & Imp P

McMichal vs French David Scott Spbd & Imp P

Russell vs Sessney David Steele SB & Impl B.

The Granjury for the Inquest of the body of this County returned, and haveing ret'd Several Indict true bills, It is Ord that the Kings Atto do pros them and that the Clk do Issue process on them Accord'gly; & also several bills of Indict being preferd & found Ignoramus, It is Ord that the same be dis'd.

Ord that the Court be Adjourned until to Morrow Morning 10 o'Clock

GEO: CROGHAN.

At a Court Con'd and held for Augusta County May 18th 1775.

Prest. Geo Croghan, John Campbell, John Gibson, Geo Vallandigham.

On the Petition of Charles Harrison and others, It is Ordered that Richard Walker, Charles Harrison, Daniel Cannon, and Isaac Pearce or any 3 of them being first sworn Veiw a road the nearest and best way to Veiw a Road from Thomas Gists house to Cap'n Fromans mill and make a report of the Conv and Inconv to the next Court.

Mitchell vs Val Crawford Wm. Crawford Spbd.

Nevell vs Gist. Wm. Crawford Spbd.

Speer vs Gist. Wm. Crawford Spbd.

P. Ed Ward, John Cannon, Wm Crawford, John McColloch.

Thomas Scott being bound over to this Court for his acting and doing Business as a Justice of the peace under Pennsylvania, in Contempt of the Earl of Dunmore's late Proclamation, as also to such other Misdemeanors as shall be then and
(25) there objected ag'st him, appeared, and On hearing him and the Wits the Court are of Opinion that he is Guilty, and it is Ord that he be Committed to the Goal of this County, and there to remain until he Enter into recog in the sum of £500, with 2 secys in the Sum of £250 Each, to be levied of their respective Goods and Chattels, Lands and Tenements, in Case Thomas Scott is not of Good Behaviour for a year and a day and, also desist from acting as a Majestrate within the Colony

of Virginia by any authority derived from the Provence of Pennsylvania, and that he keep the peace to all his Majesties Leige Subjects in the mean time.

George Croghan, Esqr. Ack'd a Deed of Bargain and Sale and a receipt thereon Endorsed to Bernad Gratz, and O R.

The same to Joseph Simon & O R.

The same to Bernard Gratz and O R.

The same to Bernard Gratz and O R

P. Thos. Smallman, Ab. Wm. Crawford.

Devorix Smith being bound over to this Court on the Complt of Susanna Styger, for asaulting, Beating & Wounding her, appeared, and on hearing the parties and the Witnesses the Court are of Opinion that the Complt be dismised with Costs

Susanna Sturgus being bound over to this Court on the Complt of Devereux Smith, for Insulting his wife and threatening her, on hearing the parties and Wits the Court are of Opinion that the Complt be dismised.

Mills vs Williamson — Pat McElroy Spbd.

Hawkins vs Hillibrand — Moses Williamson Spbd.

Cresap vs Teagarden — Wm & Geo Teagarden Spbd

vs French Moses Williamson Spbd

On the Complt of John McaNully ag'st his Master, Casper Reel, for beating & abuseing him, being Sum'd, appeared, and on hear'g the parties & the Wits the Court are of Opinion that the Complt is Groundless & be dismised, and It is Ord that the Sheriff take the Serv't and give him 25 Lashes well Laid on, and it is said to the Sheriff that Execution be done Immediately.

Casper Reel prod and made Oath to his Account of £2.16.0, his Expences in takeing up his Serv't, John McaNully, when run aw, and for 4 days absent time when run away; It is ord that he serve for the same accr to Law.

(26) Edward Armstrong being bound over to this Court on the Complt of John Miller, Senr., for takeing away a Plow & Irons with several other Utensels of Husbandry and Household furnitur, the property of the s'd John and the s'd Edward, appeared, and hearing the parties and the Wits the Court are of Opinion that he is Guilty of the facts wherewith he stands Charged, and that he be Committed to the Goal of this County, and there to remain until he Enter into recog in the Sum of £30, with 2

Secys in the Sum of £15 Each, to be levied in case he is not of Good behaviour for a Year and a day

The persons app'd to Veiw a Road from Shirtees Creek to Devor's ferry made their report; It is Ord that the Road be Established, and that David Steel and Jed Ashcraft be Overseers, and that the tith's within 3 miles on Each side work thereon.

Joseph Cisnea and Wm. Donnellsan being bound over to this Court, on the Complt of Thomas Russell for a forceable Entry & detainer, and no persons appearing It is Ord to be dis'd.

The Complt of John Quay ag'st Dav'd McClure, no persons appearing It is Ord to be dis'd.

The Complt of Adam Bell ag'st Stephen Bennett, no persons appearing it is Ord to be dis'd.

The Complt of John Boley ag'st John Springer, no persons appearing It is Ord to be dis'd.

The Complt of Wm. Thomas ag'st Chas. Froman, & no persons appearing It is Ord to be dis'd.

The Complt of Devereaux Smith ag'st Edward Thompson, no persons appearing It is Ord to be dis'd.

The Complt of John Boley ag'st Joseph Ross, no persons appearing, It is Ord to be dis'd.

Beeler vs Walls, John McNew Spbd.

(27) Edward Armstrong came into Court with Robt Strain and Philip Reely, his Secy, Ack'd himself Indeb to our Sover Lord the King in the Sum of £10 and the s'd Robt. Strain and Philip Reily Ack'd themselves Indeb to our Sover Lord the King in the Sum of £5 Each, to be levied & in case the s'd Edward Armstrong is not of good behaviour for a Year and day.

Clinton & Noble vs. Bearshers, Bazil Brown Spbd.

Walls vs Brown, Pat McElroy Spbd.

Ord that the Court be adjourned until to Morrow Morning 3 o'clock in the afternoon.

GEO: CROGHAN.

At a Court Continued and held for Augusta County May 19th, 1775,

Prest. John Gibson, Wm. Crawford, John McCullough, Edward Ward, John Cannon.

On the Motion of Benja Wells It is Ord that his Mark, a Crop and a Slit in the left Ear, be Recorded.

On the Motion of Valentine Crawford, It is Ord that his Mark, a Slit in the left Ear, a Crop and under keel in the Right Ear & O Recorded

Abt. John Gibson. Gt.

Admon of the Estate of Jacob Linnd, dec, is Granted to Thos. Smallman, Gent, and Jacob Bousman, they having with Secy. Entered into & Ack'd Bond accr. to Law.

Ord that Wm Christy, Ignace Lebath Sam'l Semple, and John Ormsby or any 3, app the Est.

Cresap vs Dowling, Josiah Wallace Spbd.

Grub vs Dowling, Josiah Wallace, Spbd.

Sinclair vs Usherwood, Jud accr, act & O Sale.

Ord that the Court be adjourned until to Morrow Morning 8 o'Clock EDWD. WARD

(28) At a Court Con'd and held for Augusta County, May 20th, 1775,

Prest. Geo. Croghan, Ed Ward, Thos. Smallman, John Gibson.

[Here follows a list of over one hundred and sixty cases, with only the surnames of the two parties and unintelligible memoranda.]

A Mortgage from Benjamin Taite to John Campbell, Gent, was produced and O R.

On the Complt of John Ross against his Master, Moses Holliday, for detaining him as a Servant Contrary to Law, it was objected to by the Master by his Atto that the Matter should not concern this Court, as the s'd Master had never been Summoned and had not any previous Notice thereof til he came to court; but the Court Overuld the Objection, it appearing to the Court that he was fully prepar'd, and on hear'g the Wits the Court are of Opinion that the Servt. be set at Liberty.

Ord that Thomas Silk be by the Church wardens of Augusta Parish bound to Jacob Bousman accr. to Law.

On the Motion of Thos. Glenn by his Atto, seting forth that he had been Committed to the Goal of this County on Suspetion of being Guilty of the Murder of his Servant, and that the proceedings of the Cald Court were Irregular, & by which he was Illegally Confined, and praying that the Court will take the same into Consideration; and the Court being of Opinion

that the Allegations are true, It is Ordered that he be dis'd from his Imprisonment.

(33) P. John Campbell & Wm. Crawford.

Geo Croghan, Gent, Ack'd a Deed of Barg & Sale to Edward Ward and O R.

The same to the same and O R.

On the Motion of Jacob Bousman, leave is granted him to keep a ferry aCross the Monongohale River from his House to the Town opposite thereto, and that he provide and keep a Sufficient number of Boats for that purpose, in ferrying over the Militia on Muster days.

On the Motion of John Ormsby, for leave to keep a ferry aCross the Monongohale River from this Town to his Land opposite thereto, being opposed by Jacob Bousman, and Motion Overuled.

Alexander Ross, Gent, Ack'd 4 deeds of Surrender and Barg & Sale to Edward Ward, Gent, and O R.

John Ormsby Ack'd a Deed of Barg and Sale to Benja Johnston & O R.

The App of the Est of Shadrach Muchmore, dec'd, being returned, is O R.

On the petition of James Erwin, It is Ord that Robt. Mckee, John Hughes, John Cavet, & John Sampson, or any 3 of them, being first sworn, Veiw a Road from the Pennsylvania Road to the Mouth of Youghioghany at Mckee's ferry, and here to meet the road that comes from Fromans Mill, and make a report of the Conven and Inconven to the next Court.

On the Motion of John Jones, on behalf Christinee Baker, It is Ord that Jacob Knight be Summoned to appear here the next Court, to shew Cause why he detains Michael Infant her Son.

(34) R Dye vs Dye A C
R Beally vs Shawn A C
R Barrakman vs Shevely A C
B McElroy vs Templin Atta
Ha Perkins vs Calloway A C
B McElroy vs Templin Atta
B Downer vs Teagarden A C
B Thomas vs Lea A C

B Swagler vs Mills Spbl. & Imp Ha
B Swigart vs Mills Aj'd
B Virgin vs Carr A C
Sims Wilson vs Cochrane A C
J G J Mills vs Hunter & A C — Hunter and Hawkins.
B Bromfeild vs Cox Atta
R Colvin vs Johnson A C
B Bond vs Long Atta
B Tigard vs Dunnivan A C
B Cresap vs Sheerer AlSub
R Colwell vs Brewster A C
R Sommer vs Brewster A C
R Colvin vs Johnson A C
J G J Sheerer vs Miller A C
B Baker vs Hendricks A C
B Whitacre vs Dixon A C
Sims Wells vs Rearden & AlSub
R Ward vs Thorn Lease Entry and Ouster Conf N G aj'd S
Ha Rodgers vs Campbell dis'd Cds Roote
S Ormsby vs Bousman Lease Entry & ouster & Conf & N G J G J
Ha Jones vs Speers De. & N G aj'd R
B Hukman vs Brumfeild Do. & N G aj'd R
Ha Miller vs Humble. Do. & N. G J G J
R Ha Clark vs Teabolt Do & N G & J G J
B Eyler vs Adams Do & N G and R
R Whitacre vs Dixon C O
R Penticost vs Linn Entry & ouster & N G & j'd B
R vs Jones Do & N G ej'd Sims
R Coin vs Miller Do. & Do. Ha
Johnston vs Swearengen. Pat McElroy Secty Costs and Lease Entry & Ouster Confered & N G ej'd Ha
(39) R Ha Girty vs Hanna Lease Entry & Ouster Confered & N G Sims
B Geegheeghan and vs Smith Do Ha
B Enocks vs Teagarden Do Ha & R
B Clinton vs Mayo Do Sims
B Hawkins vs Humble Do R

B Nicholas vs Swarnck Do J G J

J G J Lapsley vs Reed Ind and Wt of Possession & Admon of the Estate of Arthur Donerly, dec'd, is granted to John Gibson, he hav'g Comp with the Law. Ord that Chas Bruce, Ab Slower, Geo Gibson & Michl. Thorn, or any 4 of them, App the Estate.

Robt Elliott, a Deed of Barg & Sale to Wm. Elliott, & O R.

Admon of the Estate of Wm Cockrine, dec'd, g'd to Benja Elliott, he hav'g Comp'd with the Law. Ord that Benja Tomlinson, Joseph Baker & John Hendrick & Jas. Mathews or any 3, App the Estate.

His Majesties Writ for Adjourning this Court to the Town of Staunton on the 3d Tuesday in June next was produced and read, and It is Ord that the Court be adjourned accordingly

JOHN CAMPBELL.

(40) At a Cald Court held at Fort Dunmore, May the 27th, 1775, for the Examination of Thomas Glenn, who stands committed to the Goal of this County for the Murder of his Servant Man, Peter Eglington,

Present, Geo Croghan, John Campbell, Edward Ward, Thomas Smallman.

The above Named Thomas Glenn was led to the barr, and upon examination denied the fact wherewith he stands charged; whereupon several Witnesses were sworn and Examined, upon Consideration of which the Court are of Opinion that he is not Guilty of the Murder wherewith he stands Charged, but that he is Guilty of beating his Servant Ill, and that he ought to be tried for the same at the next Grandjury Court to be held at this Place, and that he be Committed to the Goal of this County, and there to remain until he Enter into recog in the Sum of £1000, with 2 Secys in the Sum of 500£ Each, for his appear at the Grandjury Court and for his good behaviour in the mean time, and that his Majesties deputy atto prosecute him for the same.

Then the Court did rise. GEO: CROGHAN.

At a Cald Court held for the Examination of James Clark, who stands committed for the Murder of Silas Tucker, an Infant son of Wm. Tucker, this 12th day of July, 1775:

Prest, Jno Campbell, Thos. Smallman, Ed Ward, Jno. Gibson.

The above named James Clark was led to the Barr, and upon Examination denied the fact wherewith he stands Charged; whereupon several Witnesses were sworn and Examined, and
(41) on Consideration of which the Court are of Opinion that he is not Guilty of the facts wherewith he stands Charged, and that for the s'd offence he be acquitted.

Then the Court did rise

JOHN CAMPBELL.

At a Cald Court held at Fort Dunmore for Augusta County, September 12th, 1775, for the Examination of Wm. Evans for the breaking open the Kitchen of James McCashlin.

Prest. John Campbell, Dorsey Penticost, Wm. Crawford, John McColloch, Wm. Goe.

The above named Wm. Evans was led to the Barr, and upon Examination denied the fact wherewith he stands Charged; whereupon several Witnesses were sworn and Exam'd, on Consideration of which the Court are of Opinion that he is not Guilty of the Burgaly, but that he is guilty of a Trespass; It is Ord that he be Committed to the Goal of this County, and there to remain until he enter into recog in the sum of £50, with 2 Secys in the Sum of 25 £ Each, for his App at the next Grandjury and for his Good behaviour, and the s'd Wm. Evans, with Geo Aston and Cornelius Conner, his Secys, Ack'd the s'd Evans in the Sum of 50 £ and Aston & Conner in the Sum of £ 25 Each, to be Levied, and in Case he do not Appear and for his good behaviour in the mean time, and that his Majesties dep Atto pros them for the same.

Then the Court did rise

JOHN CAMPBELL.

(42) At a Cald Court for the Examination of James Nowland this 12th Sepr. 1775, for the breaking open of James McCashlen's Kitchen:

Prest, John Campbell, Dorsey Penticost, Wm Geo, Wm. Crawford, John McColloch,

The above named James Nowland was led to the barr, and upon Examination denied the fact wherewith he stands charged;

whereupon several Wits were sworn and Exam'd, and on Consid of which the Court are of Opinion that he is not Guilty of the Burgarly, but that he is guilty of a Trespass; It is Ord that he be committed to the Goal of this County, and there to remain until he enter into recog in the Sum of £ 50, with 2 Secys in the Sum of 25 £ Each, and thereupon he with Geo Aston and John Conner his Secys, the s'd Nowlan in the Sum of £ 50 and the s'd Aston and Conner in the Sum of 25 £ Each, to be Levied, and in case they do not appear at the next Grandjury Court to be held here, and for his good behaviour in the mean time, and that his Majes. deputy Atto pros him for the same. Then the Court did rise

JOHN CAMPBELL.

His Majesties Writ for adjorning the Court from Staunton to Fort Dunmore being read this 19th September, 1775:

Pres't Geo. Croghan, Jno. Campbell,
Dorsey Penticost, Thos. Smallman.

David Shepperd took the Usual Oaths to his Majesties person and Gov, Sub the Ab Oath and test, and then took the Oath of a Justice of the Peace, and of a Justice of the County Court in Chancery, and of a Justice of Oyer & Terminer.

(43) Pres't Dav'd Shepperd, and absent John Campbell. Ord that the Sheriff contract with a Workman to repair this house ag'st to morrow, with a barr & seat for the Clk and Justices,

P. Wm. Crawford.

On the motion of Sam'l Sample, It is Ordered that his Serv't Woman, Betty McHolister, serve him 12 Mo; it App by Wits that she had a bastard, It is Ord that she Serve.

Ord that the Court be Adjorned until to Morrow Morning 10 o' Clock GEO: CROGHAN.

At a Court Con'd and held for Augusta County at Fort Dunmore, Sepr. 20th, 1775:

Present Geo Croghan, Thos. Smallman, Dorsey Penticost, Dav'd Shepperd, Gentn, Justices.

Drenning vs Bay, James Gray Spbd.

David Steel took the Usual Oaths to his Majesties Person and Government, Sub the Ab Oath and test, and then took the Oath of a deputy Sheriff.

A Deed from Mordicai M Mordicai to Joseph Simon was proved by Jno. Anderson, Robt. Campbell, 2 of the Wits, & O C'd.

McQuity vs Gray, Thos Bay, Spbd.

Caldwell vs Brouster }
Sommerall vs Brouster } James Gray, Spbd.

An Indenture from John McMillen to Wm. Parkinson was provd by Jno Gab'l Jones and Benja Davis, 2 of the Wits, and O R.

Cresap vs Taylor, James Brownlee Spbd.

Morrison vs Ross, Michl Tygert Spbd.

Gillfillan vs Tygert, Jos Ross Spbd.

(44) George Wilson, Gent, being bound over to this Court for being confederate with aiding advising and abeting certain disorderly persons, who, on the Morning of the 22d of June last, Violently seized and Carried away Maj John Connolly from this place, and also adviseing others not aid the Officers of Justice When called upon to apprehend the afores'd disturbers of the peace, being called and not appearing, It is Ord that he be prosecuted on his Recog.

Richmond vs Scott, Jno. Boly, Spbd.

Christian Perkey, being bound over to this Court on the Complt of Edward Rice for Break'g down his Saw Mill dam, being call'd, app'd and Several Wits were Sworn and Exam'd; on Consideration of which the Court are of Opin that he be Committed to the Goal of this County and there to remain until he enter into Secy in the Sum of £50, with 2 Secy in the Sum of £25 Each; and thereupon he with Wm. Crawford and Haden Wells his Secys Ack'd themselves, the s'd Perkey in the Sum of £50, and the s'd Crawford and Wells in the Sum of £25 Each, to be levied, and in case the s'd Perkey is not of Good behaviour and for a year and a day.

(45) Vallandigham vs Tygart Jos Ross Spbd.

Tidball vs Martin Abm. Vaughan Spbd.

Licence to keep an Ordinary is Granted to Mordicai Moses Mordicai, he hav'g Comp'd with the Law.

Waford vs Cox Abm. Teagarden and Christopher Swigart Spbd.

Brumfeild vs Cox Am. Teagarden and Christopher Swigart Spbd.

Bond vs Mordicai. 2 Suits Ignace Labat Spbd.

The Persons app'd to Veiw a road from the Confluence of Wheeling to the foot of Laurel Hill at Conrad Walters, made a rept that they had Veiwed the same and find that there may be had a good road from the Confluence of Wheeling to the Confluence of Ten Mile on the Monongahala, and from thence to the s'd Walters; It is Ord the s'd Road be Established, and that James McCoy be over from the foot of the Laurel Hill to Chas. Hickman; and John Craig from Hickman to Wm. Teagardens ferry on the Monongohala; and Ezekiel Ross from there to John Dickensons, Junr., Reason Virgin from there to Alexr Douglas; and John Mitchell from there to the Mouth of Wheeling; and that the Tithe's in 5 Miles on each side work thereon.

James Chambers, being bound over to this Court for Common Barratry and other Misdemeanors by him committed ag'st the Peace, on hear'g and Several Witnesses sworn the Court are Opinion that the Complt be dis'd.

Val Crawford is App'd Over of the Road from Sewickley Cr to Stewarts Crossing, and that the Tith's within 3 Miles on Each side work thereon.

Lyons vs Duncan. Jas. Hamilton and Chas. Reed Spbd.

Persons App'd to Veiw a road from Fort Pitt to Becketts fort, made a report; It is Ord that the s'd Road be Established, and Andrew Pearce be Over from Beckets fort to Jas. Wilsons; Cornelius Thompson from Wilsons to the River Monongohala; James Sullivan from there to the head of the Saw Mill run, and Bashar Frederick from there to Fort Pitt; and the Tith's within 5 Miles on Each side from Fort Pitt to the Monongahala, and the Tiths, within 3 Miles on each side from the River to Becketts fort, work thereon.

Dunlavy vs Russell. Dav'd Scott Spbd.

Cresap vs Elliott

Ord that the Court be Adj'd until to Morrow Morning 10 o'Clock. GEO: CROGHAN.

(46) At a Court Con'd and held for Augusta County, September 21st, 1775:

Pres't Geo Croghan, Jno Gibson, John Cannon, John McCulloch.

Admon Of the Estate of John Campbell, dec'd, is granted his father James Campbell, he hav'g Comp with the Law. Ord that Matthew Ritchey, Rich'd Boyer, Nath'l Tomlinson, and Sam'l Clem, or any 3, app the Est.

Admon of the Estate of Jonathan Johns, dec'd, is g'd to Dav'd Johns, he hav'g Comp'd with the Law. Ord that Philip Rodgers, Robt Ritchey, Jonathan Reese, and Zedeck Springer, or any 3, app the Est.

A Deed of Barg & Sale from James Brenton to Michael Cresap Senior was prov'd by John Jeremiah Jacobs one of the Wits & O R.

A Deed of Barg & Sale from Robt Denbow to Mich'l Cresap was prov'd by Geo. Brent one of the Wits & O R.

A Deed of Barg & Sale from John Corey to Mich'l Cresap, Senr., was prov'd by Jno. Jeremiah Jacob, the Wits, and O R.

Payton Rootes Sims & Jones

On the Complt of Wm. Freeman ag'st his Master, John Collins, for beating and abuseing him, and on hearing Several Wits & the Parties, the Court are of Opinion that he is Guilty of the above abuse, and that he be Committed to the Goal of this County, and there to remain until he Enter into Recog in
(47) the Sum of £20, with 2 Secys in the Sum of £10 Each, for his good behaviour towards his Servt for the Space of One Year, and that he pay Costs.

John Collins prod an Acc't ag'st his Serv't, Wm. Freeman, who run away for 86 days absent time; It is Ord that he serve him for the same Accr. to Law, and the Expence for takeing him up is Continued til the next Court

Elliott vs Girty }
Smith vs Girty } Simon Girty Spbd.

John Collins prod an Acc't ag'st his Serv't, Moses Abraham, when run away for 86 days absent time; It is Ord that he serve for the same Accr. to Law, and the Expence for takeing him up is Continued til the next Court.

Ord that the Court be Adjorned until to Morrow Morning 10 o'Clock GEO: CROGHAN.

At a Court Con'd and held for Augusta County at Fort Dunmore Sepr. 22d, 1775.

Pres't Geo Croghan, Jno. Cannon, Thos Smallman, John McColloch.

Ord that the Court be adjorned until to Morrow Morning 9 o'clock GEO: CROGHAN.

(48) At a Court Con'd and held for Augusta County, September 22d, 1775,

Pres't. John Campbell, Wm. Crawford, John Cannon, John McColloch, Dorsey Penticost,

[Here follows another list of cases, over five hundred in number, wherein only the surnames of the parties, plaintiff and defendant, are given, with occasionally some unimportant memoranda, thus: "Croghan v. Whittaker," or "Cresap vs Bowlin, Atta." If Christian names had been given, or the nature of the action shown, this list of cases would not have been omitted.]

(61) At a Court Con'd and held for Augusta County, Sepr 23d, 1775, P. Geo Croghan, Jno. Cannon, Jno. McColloch, Dorsey Penticost, Dav'd Shepperd.

Lynch vs Jones, Jno. McCallister Spbd.

[It appearing to the Court that Geo Brent & John Gab'l Jones, practising Attos of this court, have this day insulted this court in a very gross manner, by directing the under sheriff not to appear & open the court when commanded by the Justices, met upon the adjournment of yesterday, from which directions the sheriff hesitated some time in doing his duty, & did commit other Insults highly derogatory from the dignity & Authority of this Court: It is the Opinion of this court that the sd George Brent & Jno. Gab'l Jones be suspended from practising as Attos in this Court untill the Pleasure of the General Court is known in this behalf. It is therefore Ordered that the Clerk do Certify these proceedings to the honble the General Court & that the Atto Genl be sumd, John Walker, Gent, of Albemarle, Edward Winston of Bedford, Geo. Rootes of Frederick, & Chas. Sims of West Augusta, to attend there to prove the facts alleged agst the sd Brent & Jones; & It is Ord that they be committed to the Goal of this County, and there to remain until they Enter into recog in the sum of £200 Each, with 2 Secys Each in the sum of £100 Each.][16]

[16] The entry thus embraced in [] was at first made in the minute as given, but was afterwards erased by lines drawn over it.

(62) Pres't, Jno. Campbell, Thos. Smallman; Abs, Geo. Croghan, Pres't, Wm. Crawford. Ab. Jno. Gibson & D P.

A Deed from the Sacchems or Chiefs of the Six United Nations of Indians to Geo Croghan Esqr was produced to be proved, which was objected by Chas. Sims & H. Peyton on behalf of Jno. Gibson, alledging that it is upwards of two years since the Execution of the s'd deed, that there was not 3 Wits present to prove the same; which objection was overruled, and the said Deed was proved by the Oaths of Tho. & John Walker & Ord to lie for fur proof.

Geo. Croghan Esqr. Ack'd a Barg & Sale to Thos. Lawrence & O R.

Ab. John Campbell, & pres't Geo. Croghan.

Edward Armstrong, having forfeited his recog by assaulting Prudence Labat, It is Ord that a proces ag'st him, and his Secys, on the same, and that the Sheriff take him into Custody, and there to remain until he Enter into recog in the Sum of £50, with 2 Secys in the Sum of £25 Each, for his good behaviour.

P. Dorsey Penticost

The Persons App'd to Veiw a road from Providence Mounce's Mill, by Asburger's ferry, and from thence to Catfish Camp, made a report; It is Ord that the Road be Established, and that Ezekiel Hickman be Overseer from Mounces Mill to Christof Bealers ferry on Yougha; & Morgan Morgan from there to Asburger's ferry; & Benja. Fry from there to Pidgeon Cr; and Evan Williams from Pidgeon Cr. to the East fork of Churteers Cr; and Garret Vanemon from there to Catfish Camp, and the Tith's within 3 miles on Each side work thereon

(63) A Resolution of the Convention directing a Mode for the Proceedings of the Court of West Augusta was prod and read, and thesame being approved of, Ord that the Court for the future be regulated thereby and that the same be Rec'd.

Penticost vs Jones }
vs Linn } A Dedimus to take the deps. of Barnet Johnston a Witness in the Province of Maryland, to which Object was made for want of affidavit of his being out of the Colony or his being aged and Infirm, which was Overuled and dedimus ag'd.

Kuykendal vs Smith Abel Westfall Spbd.

Brent vs Beeler Dorsey Penticost, Spbd.

Hamilton vs Goe Pat McElroy Spbd.

Morgan vs Beavers Dav'd Steel Spbd.

Wm Harden vs. Glenn Alex'r Douglas Spbd.

P. Jno. Campbell, Wm. Crawford, John Cannon, John McColloch, Dorsey Penticost.

Ord Thos. Smallman, John Cannon, John Gibson, or any 2 of them, to provide a House at the Pub Expence for the Use of Holding the Court, and that the Sheriff Contract with Workmen to put the same in repair ag't the 3d Tuesday in Jan'y next.

Ord that the Sheriff, with the Consent of Thos. Smallman, John Cannon, and John Gibson, or any 3 of them, Contract for a house for Save keeping of his Prisoners, and make a return of the whole to the next Court, at the County Expence.

(64) Wm. Hawkins took the Usual Oaths to his Majesties Person and Government, Sub the Ab Oath and test, and then took the Oath of a deputy Sheriff.

His Majesties Writ for adjorning this Court to the Town of Staunton, on the third Tuesday in Nov'r next, being read, the Court was Accordingly adjorned. JOHN CAMPBELL.

At a Court held for Augusta County at Pittsburg, October the 17th, 1775, According to an Ordinance of the Convent. held at Richmond:

Present, Geo Croghan, Thos. Smallman, John Gibson, John McColloch.

On a Complt of Wm. Freeman ag'st his Master, John Collins, for abuseing him and beating him, is Continued until the next Court, and that the Sheriff take the Servant into his Custody and provide for him or hire him out until the next Court.

It appearing to this Court by Witness that an Agreem't between John Campbell and his Serv't, James Martin, that he had to serve from the 26th December 1774, One Year and 9 Months, It is Ord that he Serve the same Accordingly

Ab Jno. Gibson;

Pres't John Campbell.

John Hume being bound over to this Court, on the Complt of Francis Wilson, for a riot and Assault Battery committed on the s'd Wilson, being called and not appearing, It is Ord that the recog be prosecuted.

James Royal being bound over to the Court on the Complt of Fra's Wilson for Assault and Battery committed on the s'd Wilson, being called and not appear'g, It is Ord that the s'd recog be continued.

Ord that the Court be adjourned until the Court in Course

GEO: CROGHAN,

(65) At a Court held for Augusta County at Pittsburg, Nov'r 21st, 1775, According to an Ordinance of the Convention held at Richmond:

Pres't Geo Croghan, Edward Ward, Thos Smallman, John Cannon, Geo Vallandigham.

Samuel Hinch is appointed Surveyor of the Highway in the room of David Steel.

The persons App'd to Veiw a road from Capn Fromans to the Mouth of Yough, made their report: It is Ord that the s'd road be Established and that John Malony and Thos. Lapsley and Edward Sharp be Survey and that Tithables with 3 miles on Each side work thereon

John Bears is App'd a Consta, and It is Ord that he be Sum'd to be Sworn.

It Appearing to this Court by Wm. Wilson that John Collins had paid £7. 10s. for takeing up his Serv't Wm. Freeman, who run away, It is Ord that he Serve Acc'd to Law for the same.

The Complt of Wm Freeman ag'st his Master, John Collins, for abuseing and beating him and, It App'g to the Court to be 2d Complt, It is Ord the Sheriff sell him Acc'd to Law.

Ord that the Court be adjorned until the Court in Course

GEO: CROGHAN.

At a Court held for the Examination of Mr. Devereux Smith, at His House, by His Petition to the Justices, this 21st November, 1775, for the Murder of Capn Geo Aston:

Pres't Geo Croghan, Thos. Smallman, John Cannon, Geo Vallandigham, Edward Ward.

(66) The above Devereux Smith was Examined, denied the fact wherewith he stands Charged, whereupon several Witnesses were sworn and Examined; on Consideration of which the Court are of Opinion that after hearing Smith by his Atto, that he is Guilty of the s'd fact wherewith he stands Charged, that he ought to be tried for the said fact at the General Court in April, on the 6th day thereof, and in Order thereto he is remanded to the Goal of this County and thence to be removed.

Be it Remembered that John Nevill, Thos. Herbert, James Nowlan, Simon Morgan, all of this County, came before our Justices and Acknowledged themselves Indebted to ours'd Lord the King in the Sum of 100 Pounds Each, to be Levied of Each of their respective Goods and Chattels, Lands and Tenements, and to ours'd Lord the King rendered upon Condition they do appear at the General Court in April next and there testify and Evidence ag'st Devereux Smith for the Murder of Geo Aston, and shall not depart with out leave of the s'd General Court

The Prisoner moved the Court that he might be admitted to Bail and It is Ordered that the Court be adjorned until to Morrow Morning at 7 o'clock, GEO: CROGHAN.

At a Cald Court Con'd and held for Augusta County for the Examination of Devereux Smith for the Murder of Capt Geo. Aston:

Pres't, Geo Croghan, Thos Smallman, John Cannon, Geo Vallandigham.

Upon a motion made by Mr. Devereux Smith by his attorney to be admitted to Bail for his appearance at the 6th day of the next General Court, the Court are of opinion that from the situation Mr. Smith is in & the circumstances attending the fact where-
(67) with he is charged, that he ought to be admitted to Bail, and that he Enter into recog on the Sum of 3000£, with 3 Securities in the Sum of £1500 Each, to be Levied, and thereupon the s'd Devereux Smith Ack'd himself in the Sum of £3000 and Robert Hanna, Aeneas McCay and Wm. Butler, his Secys, in the Sum of 1500£ Each, to be Levied of their respective goods and Chattels, Lands and Tenements, and to our s'd Lord the King rendered, upon Condition that Devereux Smith doth

personally appear on the 6th day of the next General Court, if he be able at that time to attend the s'd General Court, from the situation of his wound & state of health, if not at the succeeding Court for the Tryall of Criminals, and shall not depart upon his appearance without leave of said Court.

Then the Court did rise

GEO: CROGHAN.

At a Court held for Augusta County at Pittsburg, Jan'y 16th, 1776, According to an Ordinance of Convention held at Richmond:

Pres't, Edward Ward, Thos. Smallman, Geo Vallandigham, John McColloch, Wm. Goe.

Admon of the Estate of Alexr. Miller, dec'd, is granted to John Colhoon, Gent, he having Comp'd with the Law.

Ord that Geo Wilson, John Swearengen, John Harden, and Jos Caldwell, or any 3, App the Est.

Licence to keep an Ordin is Granted to David Duncan, he hav'g Comp with the Law.

The same to James McCashlon.

(68) Admon of the Est of Thos Elvey is Granted to Thomas Newberry, he hav'g Comp with the Law.

Ord Silas Hedge, Edward Robertson, Thomas McGuire, and John Carpenter, or any 3, App the Est.

Thomas Girty, being bound over to this Court on the Complt of Samuel Sample for Threatening to beat his wife Sarah Sample, and that he was afraid that the s'd Thos. Girty will beat or wound her, he being in fear of his Wife's Sarah's Life, being Called, appeared, and on hearing and Examining Several Witnesses the Court are of Opinion that on his makeing Concessions for his good behaviour towards her for the future be discharged.

A Mortgage from Andrew Robinson to Jacob Saylor was proved by James Berwick and John McCallister, two of the Wits, and Ordered to be Certified.

Joseph Hammet is App a Constab, and It is Ord that he be Sum'd to be sworn in.

Hugh Scott is Appointed a Consta, and it is Ord that he be Sum'd to be sworn in.

Ezekiel Dewitt is App'd a Consta, in the room of John Carpenter.

Ord that the Court be adjorned until to Morrow Morning 8 o'Clock.

EDW'D WARD.

At a Court Con'd and held for Augusta County at Pittsburgh, January 17th, 1775, According to an Ordinance of Convention held at Richmond:

Pres't Edward Ward, Dorsey Penticost, John Cannon, John McColloch, Geo Vallandigham, Wm Goe

(69) On the Motion of Rich Willis, it is Ord that his Mark be recorded, a Crop in the near Ear and a Swallow fork in the off Ear.

On the Motion of James Wright, Ord that his Mark be recorded, a Swallow fork in the Off Ear.

On the Motion of Daniel Harris, It is Ord that his Mark, a Swallow fork in Each Ear.

On the Motion of Thos. Glenn, Ord that his Mark, a Crop in Each Ear and under slit in Each.

On the Motion of Thomas Crooks, Ord that his Mark, a Crop in the Near Ear.

On the Motion of Thos. Atkinson, Ord that his Mark, a Crop and Slit in the Crop in the right Ear, and the left Ear slit down and one half Cropt off.

P. Thos Smallman.

Thos. Atkinson, being bound over to this Court on the Complt of Fras. Maines, Appeared; no prosecutor appearing, It is Ord that he be dis'd.

Samuel Mcbride is app a Constable in the room of Razon Virgin, and It is Ord that he Summoned.

Francis Morrison Mark be record, a Crop in the near Ear and a hole in the off.

Wm Hawkins Mark be record, a Crop off the left and a slit in the right.

Pet Hillibrand Mark be record, a Crop in the left Ear and a Swallow fork and under slit in the right.

Or that the Court be adjorned until the Court in Course.

EDW'D WARD.

(70) At a Cald Court for West Augusta for the Examination of Edward Armstrong for Horse Stealing, this 19th January, 1776, one the Prop of Geo Sly and the other of Jas Royal.

Pres't, Edward Ward, John Cannon, Geo Vallandigham, Dorsey Penticost, Thos Smallman.

The above named Edward Armstrong was led to the barr, and upon Examination denied the fact wherewith he stands Charged; whereupon Several Witnesses were sworn and Examined; on Consideration of which the Court are of Opinion that there is not at this time Suff Evidence to prove the fact; It is Ord that he be discharged.

Then the Court did rise

EDW'D WARD.

His Majesties Writ for Adjorning the County Court of Augusta from Staunton to Fort Dunmore being read, this 16th April, 1776:

Pres't John Campbell, Dorsey Penticost, Thos Smallman, Jno. Cannon,

Admon of the Est of Jeremiah Woods, dec'd, granted to John Stevenson, who is married to the Widow, he hav'g Comp'd with the Law.

Ord that Benj. Kuykendal, James Sullivan, Rich'd McMahon, and Peter Barrakman, or any 3, app the Estate.

Ord that the Court be Adj'd until to Morrow Morning 9 o'Clock.

JOHN CAMPBELL.

(71) At a Court Con'd and held for Augusta County, April 17th, 1776.

Pres't John Campbell, Edward Ward, Dorsey Penticost, John McColloch, John Cannon.

The Last Will and Test of Larkin Pearpoint, dec'd, was prov'd by Isaac Lamaster and Calder Haymond, two of the Wits, and O R.

Daniel Leet prod a Commission from the Colledge of Wm. and Mary to be deputy Surveyor of this County under Thos. Lewis, Gent, he hav'g taken the Oath According to Law and Ent'd in Bond with Geo Rice and Geo McCormick his Sec'y.

John Harry is App Surveyor in the room of Edward Sharp

Ab Dorsey Penticost.

A Deed of Barg & Sale from John Pearce Sen'r to John and And'w Pearce was proved by Dorsey Penticost and Moses Coe, 2 of the Wits, and O C.

Pres D. P.

A Deed of Barg and Sale from Wm. Dunbar, by his Atto Alex'r Ross, to Chas. Sims, was prov'd by Caleb Graydon and Daniel Brown 2 of the Wits, and O C.

A Deed of Barg and Sale and rec't from Alex'r Ross to Chas. Sims was prov'd by Caleb Graydon and Dan'l Brown, 2 of the Wits, & O C.

A Deed of Barg and Sale from Alex'r Ross to Chas Sims was prov'd by Caleb Graydon and Dan'l Brown, 2 of the Wits, and O C'd.

A Power of Atto from Alex'r Ross, Atto for Wm. Dunbar, to Chas. Sims prov'd by Caleb Graydon & Dan'l Brown, 2 of the Wits, and O C'd

A Power of Atto from Alex'r Ross to Chas. Sims was prov'd by Caleb Graydon and Dan'l Brown, 2 of the Wits, and O C'd.

On the Motion of Christopher Carpenter, leave is granted him to keep a ferry near his house on the Monongahela for the Purpose of Setting over the Militia on Muster days

(72) Solomon Froman is app a Consta in the room of Nath'l Blackmore, and that he be Summoned before Mr. John Cannon to be Sworn into the said Office.

Admon of the Estate of John Edwards, dec'd, is granted to Benjamin Kuykendall (Jersey Ben), a C'r, he hav'g Comp'd with the Law.

Ord that Zadock Wright, Gab'l Cox, Benja Sweet, and Isaac Custard, or any 3, app the Est.

Robert Morely, Thos. Peake, & John Hatchway, being bound over to this Court on the Complt of Peter McCawley, and he being called and not appearing It is Ord that he be dis'd.

James Innis, John Munn, and Thos. Edginton, 3 of the persons appointed to Veiw a road from Froman's Mill on Shirte to Fromans Mill on the East side of the Monongohela; It is Ord that the s'd Road be Est, and that John Munn be Surv from Froman's Mill on Shirtee to the fork of the road to that goes to Henry Spears, and that Tobias Decker from thence to the Mill

on the Monongohala, and that the tithe's within 3 Miles on Each side work thereon.

Wm Andreas is App a Consta in the room of Joseph Hill, Sen'r., and that he be Sum'd to be sworn before Dorsey Penticost.

Peter Hursh is App a Consta in the forks of Yough, and that he be Sum'd to be Sworn before D. Penticost.

Jonathan Paddock is App a Consta in the room of Wm. Teagarden, and that he be Sum'd to be Sworn before Wm. Goe.

Deed of Lease and Release of Trust from Wm. Trent, Rob't Callender, David Franks, Joseph Simon, Levy Andrew Levy, the s'd Wm. Trent, Dav'd Franks, Joseph Simons, and Levy And'w Levy in their own Right, and in Right of Philip Boyle,
(73) John Chevalier, Peter Chevalier, Jos Bollock, Peter Baynton, devesees of John Baynton' Share; Sam'l Wharton by his Attos Thos Wharton and the s'd Wm. Trent, Geo Morgan, Thos Smallman, and Geo Croghan, the afores'd Sam'l Wharton Trustee for and of John Welch's Share in thes'd Premises, by his Attos, Thos Wharton and Wm Trent, Edward Moran, Evan Shelley, Sam'l Postlethwaite, Jno Gibson, Edward Cole, Grantee or Ass'e of Rich'd Winstons Share, Dennis Crotan, Wm. Thompson, Rich'd Neave Grantee or Ass'e of Ab'm Mitchell's Share in the Premises, by Rich'd Neave, Junr, his Atto, James Dundas, Jno Ormsby by his Atto Thos Bond, Jr., Wm. Edgar by his Atto, the s'd Rob't Callender, Wm Franklin, Esqr., Jos Galloway, Esqr., and Thos Wharton, to Rich'd Bache, Owen Jones, Jun'r, and Isaac Wharton, was prov'd as to Wm. Trent, Rob't Callender, Dav'd Frank, Levy And'w Levy, Joseph Bollock, Peter Baynton, Thos Wharton, and the s'd Wm Trent, in two Places, for and on behalf of Sam'l Wharton in his own right, as Trustee of John Welch by George Morgan, Edwd Cole, Thos Bond, Jr., for and on behalf of his Constituent, John Ormsby, by the s'd Rob't Callender, for and in behalf of his Constituent Wm Edgar, by Dr. Benja. Franklin for his Constituent Wm. Franklin, Esqr, and by the s'd Thos Wharton by Jno Chevalier, Peter Chevalier, Rich' Bache, Owen Jones, Jun'r., Isaac Wharton by Rich'd Butler, Jos Westmore & Thos. Flinn, and prov'd as to Rich'd Neave by his Atto Rich'd Neave, Jr, Joseph Galloway, Jos Simon,

James Dundas, Wm. Thompson, Sam'l Postlethwaite by Jos Westmore, Chas. Matheson & Thomas Flinn, & as to John
(74) Gibson was prov'd by Joseph Westmore, Chas. Matheson, and Rich'd Butler, and O R. A Deed of Partition from and between the same Persons was proved as before and O R.

A Mortgage from Abraham Mitchell and Sarah his Wife to Rich'd Neave was prov'd by Jos Westmore, Chas. Matheson, and Thos. Flin, 3 of the Wits, and O R.

Philip Whitezell is App a Consta in the room of Andrew Robertson.

John Dousman is App a Consta in the Town of Pittsburg, and It is Ord that he be Sum'd.

Philip Whitezel Ap'd and took the Oaths and the Oath of a Constable.

Wm. Forsythe, being bound over on the Complt of Henry Woods, and thes'd Henry being called and failing to appear It is Ord to be dis'd

Licence to keep an Ord is Granted to Thos. Brown at his House at Redstone Fort, Bazel Brown hav'g on his hehalf Ent'd into Bond Accr. to Law.

Licence to keep an Ord is granted to John DeCamp, he hav'g Comp with the Law.

Hawkins vs Greathouse, Gar; Abraham Miller affirmed he has 1 Watch, and that he is Indebted to him also £8 Pennsylvania Money, for which he has Passed his Bond for, and that he has had no notice of any assignment; Acc't prov̄ed & Jud and O Sale and Ord Condem'd.

(75) Sam'l Griffith is App'd a Consta; It is Ord that he be Sum'd before Wm. Goe to be Sworn into the Office.

John Greathouse is App a Consta; It is Ord that he be Sum'd before Geo Vallandigham to be Sworn into the s'd Office.

Ord that the Court be Adj'd until to Morrow Morning 10 o'Clock JOHN CAMPBELL.

At a Court Con'd and held for Augustȧ County, April 18th 1776,

Pres't, John Campbell, Edward Ward, Dorsey Penticost, John Cannon.

A Deed from Alex'r Ross, Atto to Wm. Dunbarr to Chas. Simons, being form prov'd by Caleb Graydon and Chas. Sims, was fur prov'd by Jas Mckee, the other Wit, & O R.

A Deed from Alex'r Ross to Chas. Sims prov'd as above and O R.

A Deed from Alex'r Ross to Chas Sims prov'd as above & O R.

A Power of Atto from Alex'r Ross, Atto for Wm. Dunbar, to Chas Sims, prov'd as above, O R.

A Power of Atto, from Alex'r Ross to Chas Sims proved as above, O R.

Licence to keep an Ord is Granted to Jacob Winemiller, he hav'g Compl'd with the Law.

(76) On the Petition of James Mitchell & others seting forth that a Road is Established from Conrad Walters, by Wm. Teagarden's ferry, to the Mouth of Wheeling, which is very Inconveniant to your Petrs, & praying that a Review of the s'd Road be made, It is Ord that Ebenezer Zane, James McMahon, David Owens, Henry Vanmatre, Dav'd Evans, Geo. Cox, James McCoy, & John McClalan, or any 6 of them, being first Sworn, Veiw if the old Road Estab is Conv, if not make a report of the most Conv way, and the Inconv and Conv thereof, to the next Court; that the Surveyors desist from working on the road until the report is returned

Ord that the Sheriff Summon 24 Persons to serve as a Grand jury in May next

Ord that the Court be adjorned until the Court in Course

JOHN CAMPBELL.

At a Court held at Pittsburgh, for the District of West Augusta the Twentieth day of August, 1776:

Present, Edward Ward, Dorsey Penticost, John Gibson, David Sheperd, John Cannon, and William Goe, gent.

Dorsey Penticost and John Gibson, Gent, administered the Oath prescribed by an ordinance entitled "an ordinance to enable the present Magistrates & officers to continue the administration of Justice & for setling the General mode of Proceeding in criminal and other cases, till the same can be more amply provided for," to Edward Ward, Gent, and then the said Ed-

ward Ward administered the aforesaid oath to John Gibson, Dorsey Penticost, John Cannon, David Shepherd, and Wm. Goe, Gentn. David Shepherd, and John Cannon, Gent, are
(77) appointed to Contract with some person or persons to build a house 24 by 14 With a petition in the middle, to be Used for a Goal at Augusta Town.[17]

John Madison, Jun'r, Deputy Clerk, took the Oath appointed by an Ordinance of Convention.

Patrick McElroy, Deputy Sheriff, took the Aforesaid Oath.

Court Proclaimed.

McKinley vs Beal, Agreed, pd.

Samuel Newell and Michael Thorn, being bound over on the Complt of James Chambers, who being called and not appearing to prosecute It is Ord that they be discharged.

Dav'd Steel, a Deputy Sheriff, took the Oath appointed by an Ordinance of Convention.

Admon of the Estate of Joshua Hudson, dec'd, granted to his brother Wm. Hudson, he hav'g Comp with the Law.

Ordered that Robert Jones, John Jarrett, Henry Hall, and Aaron Jenkins, or any 3, App the Estate.

Ord that all the Constables be Summoned to be Sworn agreable to the Ordinance of Convention before the most Convenient Magistrate to them.

Edward Ward, Dorsey Penticost, and John Gibson, Gentn, are recommended as proper persons for his Excellency to choose one of them to Act as Sheriff for the Ensüing Year.

Alex'r McKee, Philip Ross, Benja Kuykendall, John Nevill, David Rodgers, Isaac Cox, Geo McCormick, Matthew Ritchey, Wm. Louther, John Evans, Jas. Chew, David Scott, John
(78) Harden, Sen'r, John Swearengen, Thomas Gaddis, James McCoy, Wm. Harrison, John DeCamp, Caleb Graydon, Henry Heath, Sam'l Newell, Thos Brown, James Hammond, Thos Freeman, Wm Moore, Joshua Wright, Rich'd Yeats, John McDowell, Erasmus Bokias, David Enocks, James Hopkins, Henry Enocks, Henry Vanmetree, Chas Dodd, Daniel Mcfarlane, John Mitchell, James Caldwell, John Walker, John Williamson, Sen'r, Wm. Scott, Thomas Polk, David Andrews, John Mc-

[17] This Augusta Town, was at Catfish-camp, afterward Washington, Washington Co., Pa.

Donald, Oliver Miller, Zachariah Spriggs, And'w Swearengen, Benja Fry, Jonathan Coburn, John Hamilton, and Jonas Freind, are recommended as proper persons to be added to the Commission of the Peace.

Moses Williamson, Jun'r, is App'd a Constable, and It is Ord that he be Sum'd to be Sworn into the office before Mr. David Shepherd.

Ord that the Court be adjorned until the third Tuesday in September next to Catfish Camp[18] Augusta Town

EDW. WARD.

At a Court held at Augusta Town for the district of West Augusta the [September] 17th 1776:

Pres't, Edward Ward, Dorsey Penticost, John Cannon, David Shepherd.

Pat McElroy, deputy Sheriff, protested against the Insuff of the Goal, & on his motion Ord to be Certified.

(79) Ord the Sheriff Summon 24 Freeholders to serve as a Grand-jury at this Court in November next.

Ord that the Court be adjorned until to Morrow Morning 6 o'Clock.

EDW'D WARD.

At a Court Continued and held at Augusta Town, for the district of West Augusta, September the 18th, 1776:

Present, Edward Ward, Dorsey Penticost, John Cannon, David Shepherd, Gentlemen, Justices.

John McColloch, Gent, took the Oath appointed by Order of Convention as a Justice.

Present, John McColloch.

Wm. Hawkins, a deputy Sheriff, took the Oath appointed by Order of Convention as a deputy Sheriff.

David Rodgers, Isaac Cox, John McDowell, Richard Yeats, Wm. Scott, Dan'l Mcfarlen, John McDaniel, George McCormick, Philip Ross, James McMahon, Benja Kuykendall, Wm Lowther, John Evans, David Scott, John Harden, Senr., John Swearengen, Thos. Gaddis, Wm. Harrison, Sam'l Newell, Thos Brown, Thos Freeman, Joshua Wright, Erasmias Bochias,

[18] These words, "Catfish Camp," are erased in the original minutes, and Augusta Town substituted.

Henry Enocks, Henry Vanmetre, James Caldwell, John Williamson, Senr., Thos. Polke, Oliver Miller, Zachariah Spriggs, Benja Fry, Jonathan Coburn, John Hamilton, Zachariah Morgan, Benja Wilson, Wm. Hamen, Moses Thompson, Ephraim Ritchardson, James Walker, James Anderson, Alex'r Maxwell, Amaziah Davidson, Jacob Cook, Matthew Ritchey, Jacob Haymaker, Thomas Crooks, Thomas Waller, James Wherry, Ab'm Inloe, James Linley, And'w Swearengen, Wm. Rankin are recommended as Proper persons to be added to the Commission.

(80) Patrick McElroy is appointed to go Express from this Place to Wmsburgh for the Commission of the Peace. The Sheriffs Commission, and the Acts of Assembly and the Ordinances of Convention for the district of West Augusta

And'w Nangle and Rob't McKinley are appointed Constables in the Town of Pittsburgh, and that they be Summoned before Edward Ward, Gent, to be Sworn into the s'd Offices.

John Dousman, who was appointed a Consta in the Town of Pittsburgh and refusing to swear into the said Office, It is Ord that for the s'd Contempt he be fined £2.

Richard Yeats, John Campbell, & James McMahon are recommended as proper persons for Coroners.

Andrew Vaughan, on behalf of Jos. Horton, Moved for a Judg Ag'st John Christian, High Sheriff, for the Amount of an Exn recovered by Francis Brown, a deputy of the s'd Joseph Horton, against Adam Bell Pat McElroy, a deputy also, and who farmed the same of the s'd Christian, appeared and confessed a Judgment. Pat McElroy, a deputy Sheriff, on behalf of John Christian, moved for a Judgment ag'st Francis Brown, a deputy also, and Daniel Brown and Wm Christy his Sec'y, for the Amount of the Judg, and Costs obtained ag'st him by Jos. Horton, for the Amount of the Ex'n of the s'd Jos ag'st Adam Bell, received by the s'd Francis, and Judgment is granted

Ab Dorsey Penticost

(81) The Court on Considering the Ordinance of Convention for holding a Court in the district of West Augusta without Writ of adjournments from East Augusta, on the third Tuesday in every Month, at such place as they shall appoint, are of Opinion that

by such Ordinance they are a separate and distinct County and Court from that of East Augusta, and they do appoint Dorsey Penticost, Esqr., there Clerk for this Court, to which John Madison, Jun'r deputy Clerk, on behalf of John Madison, Clerk of the County, objected to the appointment, alledging that they had no right so to do till the division of the County, looking upon him as Clerk of East Augusta and the district of West Augusta till a division is made by an Ordinance of Convention.

Ord that John Madison, Jun'r deputy Clerk, in whose Custody the records of the adjorned Court for this district are, is ordered to deliver them to this Court on the 25th of October next.

Ordered that the Court be adjorned until the Court in Course. Edw'd Ward.

At a Court held for the district of West Augusta at Augusta Town, November 19, 1776:

Present, Edward Ward, John McColloch, John Cannon, William Goe, David Shepherd.

Thomas Glenn, who was bound by recog to Appear at the Grand jury Court, appeared, and was Ord to be prosecuted for beating his Serv't. No prosecutor or Witnesses appearing, it is ordered that he be discharged.

Ord that the Court be adjorned until to Morrow Morning 8 o'clock Edw'd Ward.

At a Court Cont'd and held for the district of West Augusta County, November the 20th, 1776:

Present, Edward Ward, John McColloch, John Cannon, David Shepherd,

Capt'n Wm. Christy prod a Com of Capt'n of a Comp'y of Militia, took the Oath required by Ordinance of Convention O C'd.

Leiut Jacob Bousman, the same

Ensign Hugh Smith.

[Here the minutes of this court end.]

INDEX.

Publications of the Carnegie Museum Serial No. 8

ANNALS

OF THE

CARNEGIE MUSEUM

Vol. I. No. 1

1901

CONTENTS.

Publications of the Carnegie Museum Serial No. 12

ANNALS

OF THE

CARNEGIE MUSEUM

VOL. I. No. 2

October, 1901

CONTENTS.

Publications of the Carnegie Museum Serial No. 14

ANNALS

OF THE

CARNEGIE MUSEUM

Vol. I. No. 3

March, 1902

For sale at Messrs. Wm. Wesley & Sons, 28 Essex St. Strand, London, England, Messrs. R. Friedlaender u. Sohn, 11 Carlstrasse, Berlin, N. W. 6., Germany, and at the Carnegie Museum, Schenley Park, Pittsburgh, Pa., U. S. A.

CONTENTS.

Publications of the Carnegie Museum Serial No. 16

ANNALS

OF THE

CARNEGIE MUSEUM

Vol. I. No. 4

September, 1902

For sale at Messrs. Wm. Wesley & Sons, 28 Essex St. Strand, London England, Messrs. R. Friedlaender u. Sohn, 11 Carlstrasse, Berlin, N. W. 6., Germany, and at the Carnegie Museum, Schenley Park, Pittsburgh, Pa., U. S. A.

CONTENTS.